EVALUATION OF LARGE TERMINAL RADAR APPROACH CONTROL FACILITIES CONSOLIDATION BENEFITS

NAS Configuration Management and Evaluation Staff

Program Evaluation Branch (Air Traffic Organization-Safety)

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Executive Summary

Terminal Radar Approach Control (TRACON) facilities consolidation has been a policy endorsed by the Federal Aviation Administration (FAA) for more than 30 years. The primary goal of the current policy is to ensure that consolidation is considered for TRACONs when there is a specific operational need and a cost benefit. To determine how a project will address requirements of the consolidation policy, FAA, through its Investment Analysis process, compares the costs and benefits of alternative actions in Cost Benefit Analysis reports.

The evaluation is an initial request from the sponsors, Charlie Keegan, former Associate Administrator for Research and Acquisitions (ARA-1) and Steve Brown, former Associate Administrator for Air Traffic Services (ATS-1), who are now part of the new Air Traffic Organization (ATO). The ATO will consolidate the FAA's air traffic services, research and acquisitions, and Free Flight activities and will focus primarily on assessing current air traffic service activities and programs to identify opportunities for improved performance and cost effective operations. The sponsors requested the Program Evaluation Branch in the Office of Safety Services (ATO-S) to conduct this evaluation of the costs and benefits realized at consolidated TRACONs. It is hoped that the results and findings of this evaluation can serve the new ATO as an initial step in providing guidance for improving future FAA facilities consolidations.

FAA's most recent consolidated TRACONs are at Atlanta, Northern California and the Baltimore/Washington/Virginia Tri-State (Potomac) area. The Atlanta Consolidated TRACON is comprised of the Atlanta and Columbus TRACONs and the Macon Rapid Approach Control; the Northern California Consolidated TRACON is comprised of the Bay, Monterey, Stockton, and Sacramento TRACONs; and the Potomac Consolidated TRACON is comprised of the Dulles, Andrews Air Force Base, Reagan National, Baltimore Washington, and Richmond TRACONs. We selected these three consolidated TRACONs for evaluation because they had the most complete and accessible investment analysis documentation. In addition, these three efforts represented multi-facility consolidations, unlike some older projects, such as those at Dallas-Fort Worth, Denver, and Chicago, which more closely represented facility replacements.

In order to understand the realization of expected costs and benefits at the three recent consolidated TRACONs, the evaluation team assessed the baselines of estimated costs and benefits reflected in the cost benefit analyses. The team met with various groups involved with FAA consolidation policy and planning, including staff members of the Terminal Business Unit, in order to gain an understanding of FAA's TRACON consolidation history and background. The team also reviewed various policy and planning reports for each of the three consolidated TRACONs.

In order to evaluate the benefits resulting from the three consolidation projects, the evaluation team met with facility managers, Air Traffic (AT) and Airway Facility (AF) managers, and regional personnel; gathered and analyzed user benefit data contained in headquarters' databases; and obtained and analyzed cost information from Terminal Facilities Branch of the Terminal Business Unit and the Financial Management Division of the Resources Management Program.

The data obtained during our evaluation were used as the basis for the findings and recommendations in this report.

Findings and Recommendations

The evaluation team determined that there are distinct differences among the Atlanta, Northern California, and Baltimore/Washington/Virginia Tri-State (Potomac) area TRACON consolidations. As a result, specific findings regarding the realization of expected benefits are presented separately for each facility. Specific recommendations are determined for each consolidated TRACON followed with some general recommendations for all consolidated TRACON efforts.

Atlanta Consolidated TRACON

Findings

1. The Atlanta Consolidated TRACON was completed nine months behind schedule.

2. The Atlanta Consolidated TRACON was completed within budget, as the actual Facilities and Equipment (F&E) costs were 23 percent lower than estimated.

3. The Atlanta Consolidated TRACON Operational and Maintenance (O&M) staffing costs for FY 2003 were 53 percent higher than estimated; therefore, the expected levels of cost effectiveness and efficiency may not be achieved.

4. The actual operations to date at the Atlanta Consolidated TRACON can be better characterized as a co-location of TRACONs rather than a true consolidation.

5. The user benefits originally identified in the Atlanta Consolidated TRACON cost benefit analysis have yet to be realized.

6. Qualification of AT controllers from the Macon and Columbus TRACONs on Atlanta Consolidated TRACON airspace has been more difficult than expected because of a high percentage of anticipated training failures.

7. Successful AF efforts that have resulted from TRACON consolidation could be threatened by AF personnel understaffing.

Recommendation

1. Director for Air Traffic Resource Management Program should conduct an external review of the Atlanta Consolidated TRACON AT training processes to ensure that the program is providing the controllers from Macon and Columbus the best possible chance to qualify in the Atlanta Consolidated TRACON airspace.

Northern California Consolidated TRACON

Findings

8. The Northern California Consolidated TRACON was completed nearly two years behind schedule.

9. The Northern California Consolidated TRACON was completed within budget, as the actual F&E costs were six percent lower than estimated.

10. The Northern California Consolidated TRACON O&M staffing costs were 15 percent higher than expected in 2003 due to increased AT staffing costs resulting from several factors, including reverse-commute costs.

11. After a year and a half in operation, user benefits from the consolidation of airspace are beginning to be realized at the Northern California Consolidated TRACON.

12. Departure delays have been reduced since the Northern California Consolidated TRACON became operational.

13. Increased user benefits are anticipated once the Mosaic of radar data is implemented at Northern California Consolidated TRACON.

14. Consolidation of functions into a single facility in Northern California has led to an increasingly productive work environment.

Recommendations

2. Director of Air Traffic Services should ensure that the Northern California Consolidated TRACON controllers, currently working at Oakland En Route Center, are returned to the Northern California Consolidated TRACON at the earliest possible time. This action would relieve understaffing at the Northern California Consolidated TRACON and end reverse-commute costs.

3. Director of Air Traffic Services should ensure the completion of finalized mapping certification and separation procedures to facilitate use of Mosaic at Northern California Consolidated TRACON.

Potomac Consolidated TRACON

Findings

15. The Potomac Consolidated TRACON was completed seven months behind schedule.

16. The Potomac Consolidated TRACON was completed at higher costs than budgeted, as the actual F&E costs were 46 percent higher than estimated.

17. Overall, the Potomac Consolidated TRACON O&M staffing costs in 2003 were five percent lower than estimated.

18. The accumulation of quantifiable user benefits at the Potomac Consolidated TRACON is limited due to problems with airspace redesign and additional operational requirements resulting from the events of September 11th.

19. Communication among staff has improved because of the consolidation of all Washington, D. C. metro air traffic control functions into one facility.

20. Additional requirements resulting from the events of September 11th have put a strain on the Potomac Consolidated TRACON controller workload.

Recommendation

4. Chief Operating Officer of the Air Traffic Organization (ATO) should ensure that the Potomac Consolidated TRACON is adequately staffed to meet the increased restricted airspace demands resulting from the events of September 11th.

Overall Recommendations

Overall, we recommend that the ATO ensure the following:

1. All future Investment Analysis cost benefit studies include an operational and cost baseline sufficiently detailed to assist in future management decisions. The operational baseline will specify how benefits will be derived while the cost baseline will summarize and present cost data in the same format as FAA records its incurred costs. These recommendations are meant to ensure that all actual collected costs and benefits can be matched to the baseline for comparability and evaluation.

2. Controllers in all consolidated TRACONs are properly trained and qualified to improve workforce flexibility and cohesion.

3. The newly-structured ATO's vice presidents for future consolidated TRACONs have more control over the Joint Resources Council-approved cost baseline. Therefore, TRACON managers can avoid cost and schedule impacts caused by budget cuts, allowing them to quickly and efficiently address variances in equipment solutions, facility and employment requirements, and other unplanned changes.

4. Candidates for controller positions at future consolidated efforts are properly screened to determine ability to qualify on new consolidated facility airspace. This will help to avoid the additional costs associated with moving and training employees who later are unable to be certified.

5. The current AF staffing and training standards requirements should be reviewed to ensure that there is proper and timely AF staffing at consolidated facilities.

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INTRODUCTION

Background

The Federal Aviation Administration (FAA) defines Terminal Radar Approach Control (TRACON) facilities consolidation as the process of combining and integrating airspace, personnel, functions, and equipment of separate terminal or en route facilities, all or in part, into a contiguous, unified operations complex to provide operational and cost benefits. The agency considers many factors before consolidating, such as alternatives of consolidation versus co-location, new building requirements such as build or lease, and political factors such as geographic boundaries and Congressional districts. Facility consolidation has been a policy endorsed by FAA for more than 30 years. The primary goal of the current consolidation policy is to ensure that consolidation is considered for facilities when there is:

- Specific operational need
- A cost benefit ratio of greater than one

FAA determines the operational needs and the cost benefit ratio of a project through its Acquisition Management System's Investment Analysis process. The findings of the investment analysis, derived through a formal procedure for comparing the costs and benefits of alternatives, are documented in a Cost Benefit Analysis Report.

During the past 20 years, FAA has competed eight consolidated TRACONs in New York, Southern California, Chicago, Denver, Dallas-Fort Worth, Northern California, Atlanta, and the Baltimore/Washington/Virginia Tri-State (Potomac) area. In August 2003, the evaluation sponsors, Charlie Keegan, former Associate Administrator for Research and Acquisitions (ARA-1) and Steve Brown, former Associate Administrator for Air Traffic Services (ATS-1), who are now part of the new Air Traffic Organization (ATO), requested the Program Evaluation Branch in the Office of Safety Services (ATO-S) to conduct this evaluation of the costs and benefits realized at consolidated TRACONs.

It is hoped that the results and findings of this evaluation could serve as an initial step in helping to provide guidance for improving future FAA TRACON consolidation efforts.

Objective

The primary objective of the evaluation is to determine the extent to which existing consolidated TRACONs are achieving expected costs and benefits, as described in the Consolidation Projects' Cost Benefit Analyses.

Scope

The focus of this evaluation is to compare the expected benefits as stated in each of the selected TRACON's cost benefit analyses to the actual benefits realized after consolidation. This will determine the extent to which expected benefits involving cost goals and improved operations were achieved.

Constraints

Based on time and resource limitations, the evaluation team limited its assessment to the three large consolidated TRACONs that were most recently commissioned. These consolidated TRACONs are Atlanta, comprised of the Atlanta and Columbus TRACONs and the Macon Rapid Approach Control; Northern California, comprised of the Bay, Monterey, Stockton, and Sacramento TRACONs; and the Potomac, comprised of the Dulles, Andrews Air Force Base, Reagan National, Baltimore Washington, and Richmond TRACONs.

Methodology

In order to assess the benefits achieved by the three selected consolidated TRACONs, the evaluation team gathered and analyzed both cost and operational data. To capture the data, the team performed the following:

- Reviewed the cost benefit analysis and other planning documentation for each consolidated TRACON. From this documentation, the team was able to determine the expected operational and cost benefits. The following cost benefit analyses were used in this evaluation:
    - Atlanta Consolidated TRACON: Life-Cycle Cost Estimate and Cost-Benefit Analysis of the Atlanta TRACON Replacement Program, Capital Investment Plan (CIP) Project 32-38, September 12, 1996.
    - Northern California Consolidated TRACON: Life-Cycle Cost Estimate and Cost-Benefit Analysis of the Northern California Metroplex Control Facility, CIP Project 32-36, October 23, 1995.
    - Potomac Consolidated TRACON: Potomac TRACON Project CIP Project F-02.005 (32-34), Life Cycle Cost Estimate and Cost Benefit Analysis, February 4, 1997 (DRAFT).
- Met with various groups involved with FAA policy concerning consolidation, including members of the Terminal Facilities Branch of the Terminal Business Unit, to gain an understanding of FAA's TRACON consolidation history and background.
- Identified key TRACON managers, Air Traffic (AT) managers, Airway Facility (AF) managers and regional personnel for interviews, and using a structured questionnaire, determined the status of actual benefits achieved. Individual facility managers and regional personnel were selected based on their knowledge of and experience with each TRACON, before and after consolidation was completed. Individuals unavailable for interviews were sent a list of the 30 questions for response.
- Gathered user benefit information from databases at headquarters.
- Obtained cost information from the Terminal Facilities Branch of the Terminal Business Unit and the Financial Management Division of the Resources Management Program.

Upon reviewing and assessing the results of the various interview sessions, document reviews, and questionnaires, the team:

- Compared schedules and cost estimates from the original cost benefit analysis with the costs actually incurred for both Facilities and Equipment (F&E) and Operational and Maintenance (O&M).
    - F&E Costs
        - Cost benefit analysis F&E Costs: We used F&E 'then year' cost contained in the cost benefit analysis reports for the analysis of F&E cost comparisons. 'Then Year' costs were calculated in base-year dollars and escalated by applying Office of Management and Budget-prescribed escalation rates.
        - Actual F&E Costs: F&E actual costs were provided by Terminal Business Unit-400.
    - O&M Cost
        - Cost benefit analysis O&M Costs: We used the O&M costs for FY 2003 contained in the cost benefit analysis reports and escalated for out years by applying OMB-prescribed escalation rates.
        - Actual O&M Costs: O&M actual costs were derived from each facility's FY 2003 Service Delivery Report provided by Financial Management Division of the Resources Management Program. AF Staffing costs include System Service Center Labor, System Management Office Labor, and Accruals and Adjustments.
- Collected delay data from the Aviation System Performance Metrics and Operations Network databases to compare operations before and after consolidation to determine if the intended benefits were realized.

We conducted fieldwork for this assessment at Headquarters, Southern, Eastern, and Western Pacific Regions from October 1 to November 14, 2003.

Following the analysis of the information gathered from the fieldwork, the team developed findings, conclusions and recommendations.

FINDINGS

The evaluation team found that there are distinct differences among the Atlanta, Northern California, and Baltimore/Washington/Virginia Tri-State (Potomac) area TRACON consolidations. These differences, which include airspace complexity, number of TRACONs within each consolidation effort, and the degree of Congressional or Agency project support, allowed for only a few general findings. Although it appears that the two consolidated TRACONs that received Agency Charters or Congressional mandates adhered better to the cost benefit analysis budget and schedule, the information concerning this matter was not conclusive. Additionally, the two consolidated TRACONs that are based on multiple major airports and complex airspace showed more anticipated employee and user benefits. Therefore, the evaluation team presented the findings regarding the realization of expected benefits for each facility separately.

As a result of these factors, and in keeping with the focus of the new ATO, the evaluation team developed and organized findings for each consolidated TRACON in terms of performance

outcomes as they relate to ATO owners, customers, and employees. Under the category of performance from an ATO owners' (FAA senior management) perspective, findings are related to the management of taxpayer dollars (F&E and O&M costs) and the realization of cost savings for the FAA. For performance related to ATO customers (airlines, general aviation, military and business aircraft), findings address the extent to which TRACON consolidations affected their operations. For performance outcomes related to ATO employees (AT and AF staff), findings address work environment and employee welfare.

ATLANTA CONSOLIDATED TRACON

The Atlanta Consolidated TRACON was originally conceived as a replacement for the TRACON at Hartsfield Jackson Atlanta International Airport. The selected alternative in the cost benefit analysis for the replacement TRACON included the consolidation of, at one time, the Columbus TRACON and Macon Rapid Approach Control with the existing Atlanta TRACON. The consolidation of the three TRACONs was expected to provide cost savings over maintaining three stand-alone facilities. Expected user benefits, resulting from more efficient airspace and route design, included optimized approach control procedures, more timely communications between TRACON and Traffic Management Unit staff members, reduction in delays, and fuel savings. Additionally, employees were expected to benefit from improvements in increased operational efficiency.

Owners

Finding 1: The Atlanta Consolidated TRACON was completed nine months behind schedule.

Though the Atlanta Consolidated TRACON was scheduled for commissioning in July 2000, the facility was not actually operational until April 2001, a delay of nine months. As a result, Atlanta Consolidated TRACON did not meet its schedule goal. The Atlanta TRACON Consolidation Project was given a charter from FAA on August 24, 1994, which provided access to top FAA management, protection from budget cuts, and flexibility in budget spending. Despite this mandate, issues did arise that prevented the Atlanta Consolidated TRACON from commissioning on schedule.

Primarily, the Atlanta Consolidated TRACON schedule was impacted when it was determined in 1998 that Standard Terminal Automation Replacement System (STARS), the automation solution originally slated for Atlanta Consolidated TRACON, would not be available for implementation in the new TRACON. The delay on a decision to replace STARS with the Automated Radar Terminal System (ARTS)-IIIE made it difficult to obtain its various components in a timely manner. For instance, FAA Headquarters' decision to move the New York TRACON ahead of Atlanta in the schedule to receive ARTS-IIIE color displays resulted in a six-month delay at the Atlanta Consolidated TRACON.

Finding 2: The Atlanta Consolidated TRACON was completed within budget, as the actual Facilities and Equipment (F&E) costs were 23 percent lower than estimated.

The Atlanta Consolidated TRACON met its F&E cost and budget goals despite being behind schedule. The evaluation team compared F&E cost estimates from the Atlanta Consolidated TRACON cost benefit analysis with actual F&E costs incurred, per Terminal Business Unit-400, as illustrated in Table 1.

F & E	Budget	Actual	Difference
Facilites	$29,140,501	$27,677,221	$1,463,280
Equipment	$26,795,012	$15,905,230	$10,889,782
Other	$23,158,040	$17,544,861	$5,613,179
Total F&E	$79,093,553	$61,127,312	$17,966,241

Sources: Atlanta Consolidated TRACON: Life-Cycle Cost Estimate and Cost-*Benefit Analysis of the Atlanta TRACON Replacement Program, CIP Project 32-38, September 12, 1996 and Terminal Business Unit-400*

Table 1: The Atlanta Consolidated TRACON F&E Budget v. Actual Cost Comparison

The actual facility costs were approximately five percent below those estimated although the size of the facility is more than 10,000 square feet larger than originally planned. The Atlanta Consolidated TRACON management attributes the lower facility costs to budget flexibility due to the Atlanta Consolidated TRACON Charter. The Charter allowed the Atlanta Consolidated TRACON to take advantage of cost and schedule opportunities. As a result, the Atlanta Consolidated TRACON building size was increased from the originally estimated 78,000-square-foot facility to 90,000 square feet with only a slight cost increase over cost benefit analysis estimates. The larger building provided the Atlanta Consolidated TRACON the space to better accommodate equipment and growth requirements.

Also attributed to the flexibility allowed by the Charter, the procurement and installation of the National Airspace System (NAS) equipment was completed at a cost of 41 percent less than originally planned. Southern Region managers were able to complete equipment installation under budget, for more than $10 million less than the original cost benefit analysis estimate, despite the change in automation equipment solution from STARS to ARTS-IIIE.

Finding 3: The Atlanta Consolidated TRACON Operational and Maintenance (O&M) staffing costs for FY 2003 were 53 percent higher than estimated; therefore, the expected levels of cost effectiveness and efficiency may not be achieved.

The evaluation team compared O&M staffing cost estimates from the Atlanta Consolidated TRACON cost benefit analysis with actual O&M staffing costs from FY 2003, as illustrated in Table 2.

O & M (2003)	Budget	Actual	Difference
AF Staffing	$8,503,320	$6,531,665	$1,971,655
AT Staffing	$14,669,854	$28,851,275	-$14,181,421

Sources: Atlanta Consolidated TRACON: Life-Cycle Cost Estimate and Cost-Benefit Analysis of the Atlanta TRACON Replacement Program, CIP Project 32-38, September 12, 1996 and Atlanta Service Delivery Report; Financial Management Division of the Resources Management Program

Table 2: The Atlanta Consolidated TRACON O&M Staffing Budget v. Actual Cost Comparison

Driving the higher-than-expected levels of O&M staffing costs at the Atlanta Consolidated TRACON are the AT staffing costs, which are 96 percent greater than the original cost benefit analysis estimate for FY 2003. The Atlanta Consolidated TRACON was not able to meet its O&M staffing cost goals due to two significant pay increases to its controllers. The first increase, which resulted from the 1998 National Air Traffic Controllers Association (NATCA) collective bargaining agreement, provided all air traffic controllers pay increases and was implemented after completion of the Atlanta Consolidated TRACON cost benefit analysis. The second pay increase resulted in March 2001 when Pay Rule 59 was introduced. This rule provided controllers transferring to the Atlanta Consolidated TRACON, even from less complex facilities, substantial pay increases first when they were selected for transfer and again when they moved to the new TRACON. As a result of the NATCA Agreement and Pay Rule 59, the Atlanta Consolidate TRACON was unable to meet is O&M staff costs goals, and, therefore, the TRACON may not achieve its expected levels of cost effectiveness and efficiency**.**

On the other hand, AF staffing costs at the Atlanta Consolidate TRACON are less than anticipated in the cost benefit analysis. The primary reason for the lower than expected AF costs is that the TRACON is functioning at AF staffing levels well below those anticipated in the cost benefit analysis. Currently AF has only 66 percent of the employees estimated in the cost benefit analysis.

Finding 4: The actual operations to date at Atlanta Consolidated TRACON can be better characterized as a co-location of TRACONs rather than a true consolidation.

According to the Staff Study Guide for Air Traffic Control Facility Investment Projects, establishing a consolidated TRACON would include the process of combining and integrating airspace, personnel, functions, and equipment of separate facilities into a contiguous, unified operations complex to provide operational and cost benefits. Feedback from several managers at the Atlanta Consolidated TRACON indicates that operations are being performed in a manner more consistent with a 'co-location' - the placing of facilities and personnel at a common location without integration of functions - than a true consolidation. Though our review scope did not allow for detailed study to determine the validity of the Atlanta Consolidated TRACON managers' assessment, it could be assumed that such observations by the management staff are drawn on the facility's current operations. As a result, it appears that the Atlanta Consolidated TRACON, which services only one major airport among its 42 airports, has not been able to maximize the goal of increased operational efficiency due to consolidation.

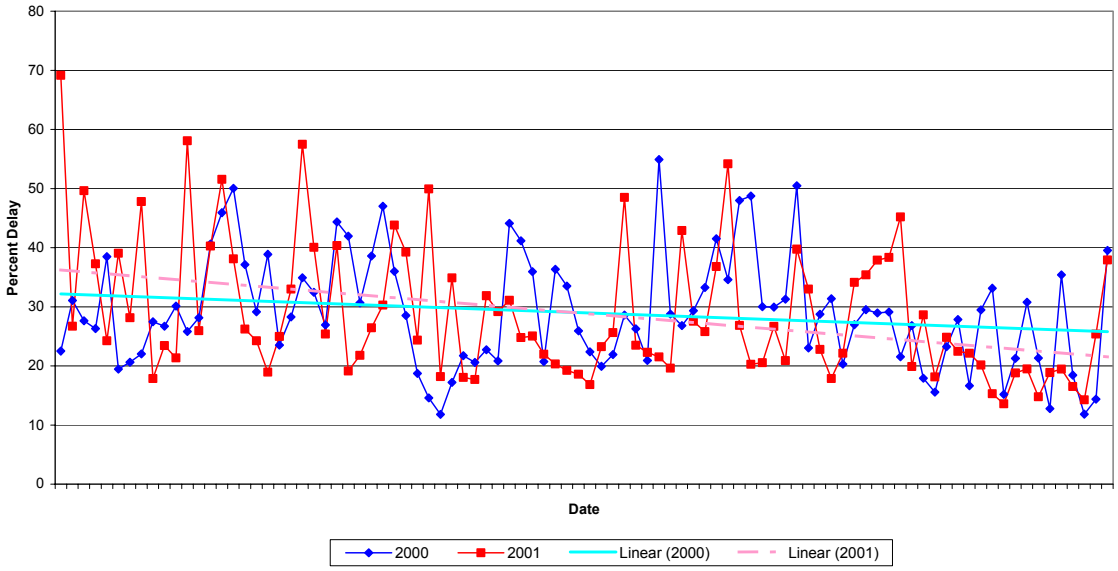
Customers

Finding 5: The user benefits originally identified in the Atlanta Consolidated TRACON cost benefit analysis have yet to be realized.

The primary user benefits, such as fuel savings and passenger value of time, identified in the cost benefit analysis for the Atlanta Consolidated TRACON, were to be derived from a new, fifth runway. The user benefits were to result from airspace changes that would have taken advantage of the fifth runway. Consolidation of the airspace would have allowed a removal of turboprop aircraft from the turbojet arrival stream. User benefits would have accrued from savings in variable operating costs and passenger value of time resulting from a more efficient flow of arrivals and increase in arrival rate provided by the new runway. However, since the approval of the Atlanta Consolidated TRACON consolidation, the Atlanta Aviation Department decided to increase the length of the fifth runway, initially designed primarily for propeller aircraft, so that it could accommodate turbojet operations. The extension of the runway pushed back the expected completion date to 2006. As a result, many of the original cost benefit analysis benefits described have not been realized.

Since the primary user benefit assumptions in the Atlanta Consolidated TRACON cost benefit analysis are no longer valid, the evaluation team analyzed delay statistics from the Aviation System Performance Metrics database. The purpose of this activity was to see if there were any significant trends in delay reduction after the Atlanta Consolidated TRACON commissioning that might be attributed to improved AT controller productivity and coordination with traffic management coordinators. The evaluation team looked at delay performance data for the summer months (June through August), before and after the Atlanta Consolidated TRACON commissioning date in April 2001, since these months normally represent peak numbers of aircraft operations. Limiting comparisons to the summer months allowed us to exclude the September 11th event from the data and minimize variation in the data associated with the sharp reduction of traffic that accompanied that date.

The delay data trends found in the Aviation System Performance Metrics data show a slight decrease in departure delay within the Atlanta Consolidated TRACON terminal area, as shown in Figure 1. Because of the multiple variables that affect aircraft delay performance, the evaluation team was unable to draw any definitive conclusion on the Atlanta Consolidated TRACON delay performance improvements since consolidation.



Source: Aviation System Performance Metrics database

Figure 1: Percent Departure Delay Atlanta - 2000 v.2001 Summer Months (June, July, August)

Employees

Finding 6: Qualification of AT controllers from the Macon and Columbus TRACONs on Atlanta Consolidated TRACON airspace has been more difficult than expected because of a high percentage of anticipated training failures.

Atlanta Consolidated TRACON managers noted that communications between AT controllers and coordination with traffic management coordinators have improved in the new TRACON. However, qualification of AT controllers from the Macon and Columbus TRACONs on the Atlanta Consolidated TRACON airspace has been more difficult than expected. Facility managers noted that they were having significant difficulty certifying Macon/Columbus controllers to work Atlanta sectors - one of the busiest terminal areas in the world. Currently, it is predicted that as many as 70 percent of the Macon and Columbus controllers may fail to certify at the Atlanta Consolidated TRACON. Feedback from employees and union representatives indicate that this may be due to the quality of training on the Atlanta Consolidated TRACON airspace for these controllers and believe that improvements to the training curriculum could help certify these controllers. The Atlanta Consolidated TRACON will not achieve the broad operational benefits of consolidation without the successful training of its facilities' employees.

Finding 7: Successful AF efforts that have resulted from TRACON consolidation could be threaten by AF personnel understaffing.

AF managers noted that equipment is much more accessible in the Atlanta Consolidated TRACON and AF technicians now have the ability to service equipment with much less disruption to the AT controllers. Additionally, the presence of an AF NAS Operations Manager on the operational floor of the Atlanta Consolidated TRACON on a 24-hour basis has improved coordination of equipment repairs.

To date, management states that the Atlanta Consolidated TRACON AF office is operating effectively and efficiently. However, the initial success of the AF efforts could be threatened by understaffing. The AF organization consists of 34 positions and is currently staffed at 33 positions. This is a lower staffing level than the original cost benefit analysis forecast requirement of 45 positions.

Recommendation

1. Director for Air Traffic Resource Management Program should conduct an external review of the Atlanta Consolidated TRACON AT training processes to ensure that the program is providing the controllers from Macon and Columbus the best possible chance to qualify in the Atlanta Consolidated TRACON airspace.

NORTHERN CALIFORNIA CONSOLIDATED TRACON

The cost benefit analysis for the Northern California Consolidated TRACON included an alternative that would combine the Bay, Monterey, Stockton, and Sacramento TRACONs and create a consolidated facility. According to the cost benefit analysis, the consolidation of the four facilities was expected to bring about cost savings by not having to replace, refurbish or maintain the four poorly maintained existing facilities. Additionally, user benefits were expected in the form of more efficient flight profiles, which would generate fuel and operating cost savings and reductions in ground delays from major route improvements. Employees were expected to benefit through improvements in operational efficiency. This alternative was chosen and scheduled for implementation in November 2000.

Owners

Finding 8: The Northern California Consolidated TRACON was completed nearly two years behind schedule.

Though originally scheduled to start operations in November 2000, the Northern California Consolidated TRACON was not commissioned until August 2002. As a result, it did not meet its schedule goal. This delay in commissioning was due to the unavailability of STARS, the automation solution originally slated for the Northern California Consolidated TRACON, as well as two substantial budget cuts. The decision to replace STARS with ARTS-IIIE and the time required to obtain and install the system seriously impacted the Northern California Consolidated TRACON's original commissioning schedule. Additionally, the Northern California

Consolidated TRACON faced two major budget cuts, one in 1999 for $9.7 million and again in 2000 for $13.5 million. Unlike the Atlanta Consolidated TRACON, the Northern California Consolidated TRACON was not given a charter protecting it from budget cuts and allowing it flexibility of budget spending. The budget cuts compounded the delays caused by the problems of replacing the STARS automation system. As a result of these two factors, the Northern California Consolidated TRACON commissioned 22 months behind schedule.

Finding 9: The Northern California Consolidated TRACON was completed within budget, as the actual F&E costs were six percent lower than estimated.

Though the evaluation team was not able to assess the cost savings associated with not having to replace, refurbish or maintain the four existing facilities that consolidated into the Northern California Consolidated TRACON, it did determine that the Northern California Consolidated TRACON met the F&E cost goals in the cost benefit analysis. Table 3 illustrates that actual F&E costs were within those estimated in the cost benefit analysis.

F & E	Budget	Actual	Difference
Facilites	$32,622,650	$47,377,975	-$14,755,325
Equipment	$38,793,354	$24,756,472	$14,036,882
Other	$30,593,879	$24,078,938	$6,514,941
Total F&E	$102,009,883	$96,213,385	$5,796,498

Sources: Northern California TRACON: Life-Cycle Cost Estimate and Cost-Benefit Analysis of the Northern California Metroplex Control Facility, CIP Project 32-36, October 23, 1995 and Terminal Business Unit-400

Table 3: The Northern California Consolidated TRACON F&E Budget v. Actual Cost Comparison

Despite budget cuts and being behind schedule due to automation problems, the Northern California Consolidated TRACON's total F&E costs were six percent lower than cost benefit analysis estimates. Facilities costs, however, for the consolidated TRACON were 45 percent higher than cost benefit analysis estimates. The increased cost for facilities is the result of two main factors: increase of facility size and cost incurred due to the 22-month delay.

- The 1995 Northern California Consolidated TRACON cost benefit analysis costs for the alternative selected reflects the amount to build a new 86,000 square foot facility, based on a version of Sverdrup's Metroplex Consolidated Facility design. This design would accommodate the four TRACONs, Bay, Monterey, Stockton, Sacramento, and parts of the Oakland En Route Center. Later the Sverdrup design was modified to better reflect equipment and growth requirements, resulting in an increase of square footage to 95,000. Additionally, associative facility costs, such as furniture and office equipment, increased proportionately.

- Although construction of the new facility was completed in 1999, the Northern California Consolidated TRACON was not operational until 2002. During this time, facility lease costs were incurred on the old facilities while utilities, maintenance, and security costs

were incurred on the new facility. According to Financial Management Division of the Resources Management Program, these costs equaled $500,000 per month.

Equipment costs at the Northern California Consolidated TRACON were 36 percent below budget. Lower actual costs compared to budget were due primarily to the following:

- Terminal Business Unit funded Northern California Consolidated TRACON's automation/controller displays. This cost of $11 million was originally in the Northern California Consolidated TRACON budget.

- With the replacement of STARS, many of the original budgeted peripheral items were no longer needed. For instance, the Northern California Consolidated TRACON no longer had to have the budgeted $6 million for STARS-required digitizers.

Finding 10: The Northern California Consolidated TRACON O&M staffing costs were 15 percent higher than expected in 2003 due to increased AT staffing costs resulting from several factors, including reverse-commute costs.

The evaluation team compared O&M staffing cost estimates from the Northern California Consolidated TRACON cost benefit analysis with actual O&M staffing costs from FY 2003, as illustrated in Table 4. The Northern California Consolidated TRACON did not meet its O&M budget goals.

O&M (2003)	Budget	Actual	Difference
AF Staffing	$7,262,559	$4,839,428	$2,423,131
AT Staffing	$27,714,131	$35,419,089	-$7,704,958

Sources: Northern California TRACON: Life-Cycle Cost Estimate and Cost-Benefit Analysis of the Northern California Metroplex Control Facility, CIP Project 32-36, October 23, 1995 and Northern California Service Delivery Report; Financial Management Division of the Resources Management Program

Table 4: The Northern California Consolidated TRACON O&M Staffing Budget v. Actual Cost Comparison

Actual FY 2003 O&M costs for AT staffing were 28 percent above budget. This discrepancy can be attributed to the following unanticipated factors from the cost benefit analysis and the impact of the 1998 NATCA agreement, signed after the cost benefit analysis:

- Pay Rule 51: This rule states that an employee from a lower complexity facility moving to a higher complexity facility will receive half a pay increase commensurate to that of the higher level facility when beginning training for the new facility airspace. The controller will receive the other half of the pay increase upon completion of the training, even if the controller is not actually moved to the new facility for a period of time. Due to the 22-month delay at Northern California Consolidated TRACON, many of the controllers completed training months before they were actually transferred to the new facility. As a result, these controllers received the higher pay level commensurate for

working a more complex airspace while continuing to work at the original, lower complexity level facility.

- Pay Rule 59: As previously mentioned, Pay Rule 59 allowed those controllers being transferred to a consolidated facility substantial pay increases first when they were selected for transfer and again when they were moved to the new TRACON. Pay Rule 59 was implemented after Pay Rule 51, so those controllers selected for transfer to Northern California Consolidated TRACON prior to the implementation of Pay Rule 59 were still held under Pay Rule 51.

- Reverse Commute: Several of the Northern California Consolidated TRACON employees had received Permanent Change of Station transfers to the Northern California Consolidated TRACON while still working at Oakland En Route Center. Due to the delay in consolidation and the unanticipated retention of the Northern California Consolidated TRACON staff at Oakland En Route Center, six employees are commuting from the Northern California Consolidated TRACON area back to Oakland En Route Center and are receiving costs of travel and temporary duty pay. These cost for reverse commute payments are estimated by Terminal Business Unit-400 at close to $400,000.

- Retraining: The controllers who were certified on the Northern California Consolidated TRACON airspace but were not moved there on time, due to commissioning delays and the retention of Oakland En Route Center employees, must be retrained. This situation leads to an unnecessary redundancy in training costs.

Like the Atlanta Consolidated TRACON, AF staffing costs at the Northern California Consolidated TRACON are less than those anticipated in the cost benefit analysis. The cost benefit analysis projected lower AF staffing costs would result due to lower maintenance requirements on new equipment. However, the Northern California Consolidated TRACON AF managers state that much of the savings result from understaffing. Currently AF at the Northern California Consolidated TRACON is authorized 50 employees but has only 46.

Customers

Finding 11: After a year and a half in operation, user benefits from the consolidation of airspace are beginning to be realized at the Northern California Consolidated TRACON.

After a year and a half in operation, the Northern California Consolidated TRACON is meeting its user benefits goal stated in the cost benefit analysis. The Northern California Consolidated TRACON involves a highly complex airspace, including 239 airports, of which 18 have towers and 6 are considered major airports. The Northern California Consolidated TRACON has successfully consolidated and restructured this airspace, while maintaining functional relationships between sectors and providing safe and efficient movement of air traffic. Table 5 lists the benefits realized from the consolidated airspace at the Northern California Consolidated TRACON:

Benefit	Measures
Productivity	▪ Increased traffic management ▪ Improved communication ▪ Improved training ▪ Standardization of procedures
Efficient Operations	▪ Reduced delays ▪ Shortened clearance times ▪ Smooth transitions ▪ Efficient change of procedures
Safety	▪ Increased safety
Capacity	▪ Increased capacity ▪ Reduction in environmental workload
Technology	▪ Advanced equipment ▪ Improved communication

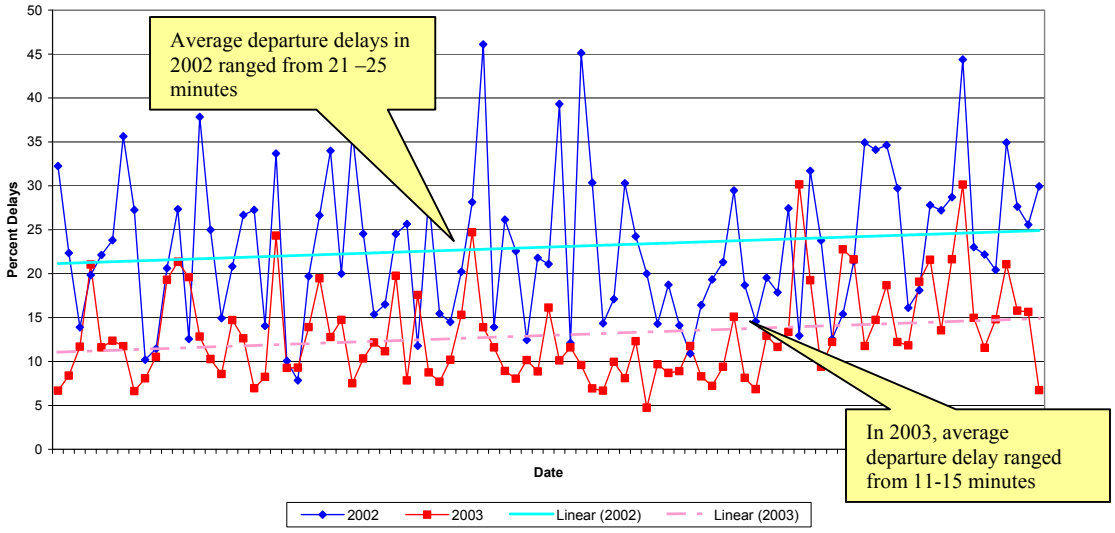
Table 5: The Northern California Consolidated TRACON Benefits Realized

In conjunction with National Airspace Redesign Program, the Northern California Consolidated TRACON is now implementing the final phase of its airspace redesign. This phase will bring six Oakland En Route Center domestic sectors and the partial lateral confines of an additional six domestic Oakland En Route Center sectors to the Northern California Consolidated TRACON airspace. The benefit of this airspace redesign is that aircraft will exit the en route environment and Class A airspace directly into the Northern California Consolidated TRACON airspace. This will provide the controllers the ability to utilize terminal separation standards and sequence aircraft further out from the airport than in the current environment. Additionally, the new design will allow the departure sectors to hand off aircraft directly to the Oakland En Route Center mid-tier sectors overlying the Northern California Consolidated TRACON's new airspace.

Finding 12: Departure delays have been reduced since the Northern California Consolidated TRACON became operational.

The evaluation team analyzed delay statistics from the Aviation System Performance Metrics database to see if there were any significant trends in departure delay reduction after the Northern California Consolidated TRACON commissioning that might be attributed to improved AT controller productivity and coordination with traffic management coordinators. The evaluation team looked at departure delay performance data for FY 2002 and FY 2003 for the months of April through June, before and after the Northern California Consolidated TRACON commissioning date in August 2002.

The delay data trends found in the Aviation System Performance Metrics data show a decrease in departure delay, between 2002 and 2003, within the Northern California Consolidated TRACON terminal area, as shown in Figure 2. This indicates that the Northern California Consolidated TRACON delay performance has improved since consolidation.



Source: Aviation System Performance Metrics database

Figure 2: Percent Departure Delay Oakland - 2002 v.2003 April, May, June

Finding 13: Increased user benefits are anticipated once the Mosaic of radar data is implemented at Northern California Consolidated TRACON.

The ARTS IIIE Mosaic display is an enhancement to the ARTS IIIE software that changes and improves the way targets are displayed for AT controllers. It retains current single-sensor functionality and provides necessary new features to future ARTS airspace management for more accurate control of aircraft. Once functional, Mosaic will enable AT controllers to better manage air traffic by providing the capability to:

- Display a 512- nautical-miles by 512-nautical-miles window comprised of multiple sensors
- Fill in blind spots
- Display a wider view for supervisors
- Combine multiple sectors during light traffic
- Provide immediate backup in case of sensor failure
- Choose between Mosaic or single-sensor display mode

All these features will translate into a better, safer management of air traffic.

At present, full implementation of Mosaic of radar data at the Northern California Consolidated TRACON is being hampered due to certification problems of both long-range mapping and three-mile aircraft separation procedures. Since the Northern California Consolidated TRACON is the FAA test site for implementation of Mosaic in the terminal environment, all other large TRACONs are awaiting its implementation of Mosaic.

Employees

Finding 14: Consolidation of functions into a single facility in Northern California has led to an increasingly productive work environment.

Employee benefits goals for improved efficiency are being met at the Northern California Consolidated TRACON. During the planning and implementation phases, management noted that the extremely close and cooperative relationship forged with the AT union representatives enabled a remarkably smooth transition for all involved. Additionally, the Northern California Consolidated TRACON management decided to train and qualify its incoming controllers before their arrival. The decision for early training allowed for a well-prepared staff that had few training failures. These two elements have allowed the Northern California Consolidated TRACON operations to avoid many of the problems that occurred at the other two consolidated facilities. Management has noticed improved communication, excellent management-employee relations, and a more proactive and knowledge-sharing environment among AT staff.

Though AF employees enjoy similar benefits from consolidation as the AT staff, the Northern California Consolidated TRACON AF group continues to be understaffed. Since an AF employee requires up to 3,000 training hours before becoming fully functional on TRACON equipment, the underemployment of AF staff is a serious problem.

Recommendations

2. Director of Air Traffic Services should ensure that the Northern California Consolidated TRACON controllers, currently working at Oakland En Route Center, are returned to the Northern California Consolidated TRACON at the earliest possible time. This action would relieve understaffing at the Northern California Consolidated TRACON and end reverse-commute costs.

3. Director of Air Traffic Services should ensure the completion of finalized mapping certification and separation procedures to facilitate use of Mosaic at Northern California Consolidated TRACON.

POTOMAC CONSOLIDATED TRACON

The cost benefit analysis for the Potomac Consolidated TRACON included an alternative that would combine the Dulles, Andrews Air Force Base, Reagan National and Baltimore-Washington TRACONs and create a consolidated facility. According to the cost benefit analysis, the consolidation of the four facilities was expected to bring about cost savings in AT Staffing and foregoing facility leases. Additionally, the reconfiguration on the Potomac

Consolidated TRACON airspace was expected to bring about user benefits such as reduction in aircraft variable operating cost, increased passenger value of time, and fuel cost savings. Finally, employee benefits were expected through improvements in operational efficiencies. This alternative was chosen and scheduled for implementation in May 2002.

Owners

Finding 15: The Potomac Consolidated TRACON was completed seven months behind schedule.

The Potomac TRACON was scheduled for commissioning in May 2002; however, it was not actually operational until December 2002, a delay of seven months. As a result, the Potomac Consolidated TRACON did not meet its schedule goal. FAA was directed by Congress in January 1998 to proceed without delay on the consolidation efforts at the Potomac Consolidated TRACON. With this congressional mandate, the Potomac Consolidated TRACON was assured access to top FAA management, protection from budget cuts, and flexibility in budget spending. Despite this mandate, issues did arise that prevented the Potomac Consolidated TRACON from commissioning on schedule. Primarily, the Potomac schedule was impacted when it was determined STARS, the automation solution originally slated for the Potomac Consolidated TRACON, would not be available for implementation in the new TRACON. The time required to obtain and install the replacement system, ARTS-IIIE, caused a seven-month delay in consolidation.

Finding 16: The Potomac Consolidated TRACON was completed at higher costs than budgeted, as the actual F&E costs were 46 percent higher than estimated.

The evaluation team compared F&E cost estimates from the Potomac Consolidated TRACON cost benefit analysis with actual F&E costs for FY 2003, as illustrated in Table 6.

F & E	Budget	Actual	Difference
Facilites	$23,506,000	$44,514,759	-$21,008,759
Equipment	$21,842,568	$28,605,416	-$6,762,848
Other	$27,340,345	$32,698,990	-$5,358,645
Total F&E	$72,688,913	$105,819,165	-$33,130,252

Sources: Potomac TRACON Project CIP Project F-02.005 (32-34), Life Cycle cost estimate and Cost Benefit Analysis, February 4, 1997 (DRAFT) and Terminal Business Unit-400

Table 6: The Potomac Consolidated TRACON F&E Budget v. Actual Cost Comparison

Facilities costs were 90 percent above budget due to the increase in facility size from the original estimate. The 1997 Potomac Consolidated TRACON cost benefit analysis Most Likely Scenario for Alternative 1 reflects the cost of building a new 65,000 square foot facility, based on a version of Sverdrup's Metroplex Consolidated Facility design. This design accommodated the consolidation of four TRACONs, Washington Dulles, Baltimore-Washington, Reagan National, and Andrews Air Force Base. Later the Sverdrup design was modified to include Richmond

airspace as well as to better reflect requirements for increased number of radars and anticipated growth. This resulted in an increase of square footage to 95,000. Associative facility costs, such as furniture and office equipment, increased proportionately. The evaluation team did not ascertain the costs savings from combining the individual TRACONs' leases.

Equipment costs were 31 percent higher than estimated as a result of implementation delays and various requirements changes. Implementation delays at the Potomac Consolidated TRACON, like the Atlanta and Northern California Consolidated TRACONs, were experienced due to the unavailability of STARS and complications with the implementation of the replacement system, ARTS-IIIE. The change in automation solution and other requirements resulted in the need for various equipment changes. An example of some of these changes follows:

- Information Display System Displays: Requirements changed from Information Display System to the Automated Weather surface Observing System Communication Equipment Information Display System, a newer, more expensive system.
- Emergency Communication System: Emergency Communication System equipment acquired provided for increased (seamless) back-up radio capacity; however, costs for increased capability were higher than the original solution.
- Surveillance and Communication Interface Processors: Original plan to 'leapfrog' Surveillance and Communication Interface Processors had to be scrapped when there were no Surveillance and Communication Interface Processors in inventory; the Potomac Consolidated TRACON costs include development costs for Surveillance and Communication Interface Processors emulators, a new national program.
- Consoles: Original estimates for consoles were included in the estimate for furniture.
- Bandwidth Manager: Cost for Bandwidth Manager was not included in the original estimate.

Finding 17: Overall the Potomac Consolidated TRACON O&M staffing costs in 2003 were five percent lower than estimated.

The evaluation team compared O&M staffing cost estimates from the Potomac Consolidated TRACON cost benefit analysis with actual O&M staffing costs for FY 2003, as illustrated in Table 7.

O & M (2003)	Budget	Actual	Difference
AF Staffing	$12,480,600	$5,205,557	$7,275,043
AT Staffing	$23,032,140	$28,505,908	-$5,473,768

Sources: Potomac: Potomac TRACON Project CIP Project F-02.005 (32-34), Life Cycle cost estimate and Cost Benefit Analysis, February 4, 1997 (DRAFT) and FY 2003 Potomac Service Delivery Report; Financial Management Division of the Resources Management Program which had only eight months costs. These costs were annualized for comparative purposes.

Table 7: The Potomac Consolidated TRACON O&M Staffing Budget v. Actual Cost Comparison

Though overall staffing costs at the Potomac Consolidated TRACON are lower than expected, the Potomac Consolidated TRACON did not meet its goal of lower AT staffing costs, which were 24 percent above budget in FY 2003. As with the Atlanta and Northern California Consolidated TRACONs, these higher AT costs can be attributed to the 1998 NATCA Agreement and the issuance of Pay Rule 59, both of which substantially increased controller salaries. Both the NATCA Agreement and Pay Rule 59 were implemented following completion of the Potomac cost benefit analysis.

AF staffing costs at the Potomac Consolidated TRACON are less than those anticipated in the cost benefit analysis. The lower costs for AF personnel is because the TRACON is functioning at AF staffing levels well below those anticipated in the cost benefit analysis. The Potomac Consolidated TRACON cost benefit analysis AF staff was anticipated to be 64 employees. Currently the TRACON has only 42 AF employees.

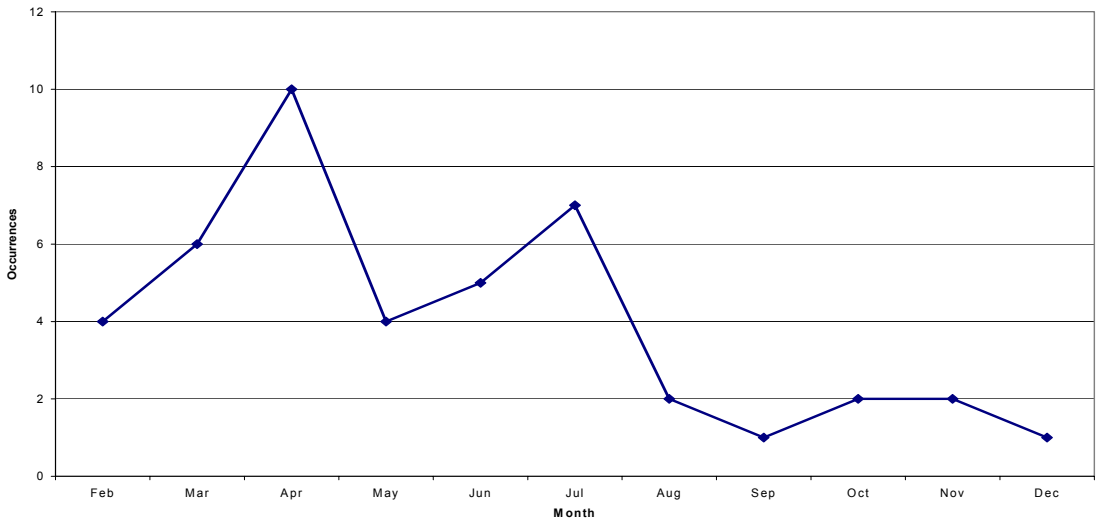
Customers

Finding 18: The accumulation of quantifiable user benefits at the Potomac Consolidated TRACON is limited due to problems with airspace redesign and additional operational requirements resulting from the events of September 11th.

The Potomac Consolidated TRACON was required to perform a detailed, three-scenario Environmental Impact Study as part of its requirements for consolidation and airspace redesign. This study took eight months longer than anticipated to complete and caused delays in the implementation of the selected airspace redesign option. Additional delays occurred due to territory conflicts with New York. On December 3, 2003, the management of the Potomac Consolidated TRACON decided to proceed with the implementation of the redesign without making changes to the north boundary of the airspace, the area under negotiation with New York, as an alternative to continued delay. This situation resulted in a loss of approximately 25 percent of the originally anticipated user benefits, according to the Potomac Consolidated TRACON AT Management.

An additional factor impacting the implementation of the redesigned airspace is the agency wide halt placed on Area Navigation procedures for the past year. The proposed benefits from the Potomac Consolidated TRACON airspace redesign rely heavily on Area Navigation departure and arrival procedures. At this time, however, the Potomac Consolidated TRACON is moving forward with the Area Navigation limitation in place.

In its first seven months of operations, the Potomac Consolidated TRACON experienced a higher-than-normal number of operational errors. These incidents were attributed, for the most part, to new air traffic procedures resulting from consolidation, AT controller understaffing, and the TRACON's new requirements for restricted airspace stemming from September 11th. After evaluating the problem and making several operational changes, the Potomac Consolidated TRACON's operational errors have significantly decreased, as seen in Figure 3.



Source: Air Traffic Service-200, Office of Air Traffic Investigations

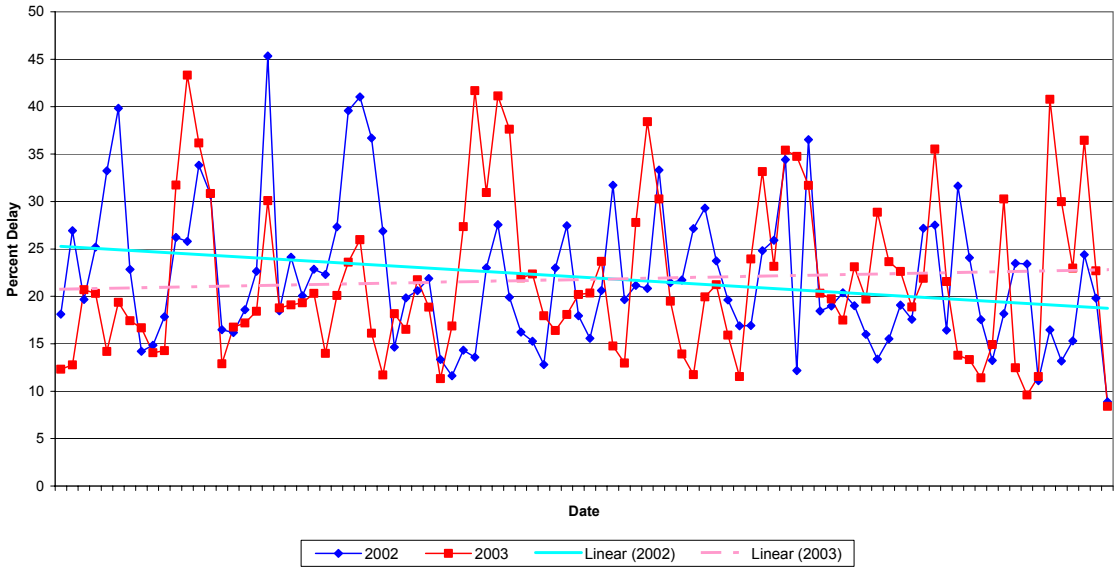
Figure 3: 2003 Occurrences of Operational Errors at the Potomac Consolidated TRACON

Despite these problems, the Potomac Consolidated TRACON has had success in restructuring its highly complex airspace, which includes 188 airports, of which 13 have towers and 5 are considered major airports. Table 8 shows the benefits realized from this consolidation. Updated technology and consolidation of functions into one facility have allowed for improved communications and coordination. Now, aircraft, which might have been grounded due to weather conditions, can now be rapidly and safely rerouted through other airspaces.

Benefit	Measure
Productivity	Improved communication
Efficient Operations	Improved coordination
Safety	Increased safety
Capacity	Improved facility
Technology	Advanced equipment

Table 8: The Potomac Consolidated TRACON Benefits Realized

Departure delay statistics from the Aviation System Performance Metrics database were analyzed to see if there were any significant trends in departure delay reduction after the Potomac Consolidated TRACON commissioning. The evaluation team looked at delay performance data for the summer months (June through August), before and after the Potomac Consolidated TRACON commissioning date in December 2002, since these months normally represent peak numbers of aircraft operations. The delay data detect little change in departure delay statistics, as shown in Figure 4, illustrating that the Potomac Consolidated TRACON terminal area has yet to realize this type of consolidation benefits.



Source: Aviation System Performance Metrics database

Figure 4: Percent Departure Delay Dulles - 2002 v.2003
Summer Months (June, July, August)

Employees

Finding 19: Communication among staff has improved because of the consolidation of all Washington, D. C. metro air traffic control functions into one facility.

The Potomac Consolidated TRACON has benefited from the improvement of operational efficiencies. The consolidation has facilitated communication among airports in the DC metropolitan area. Control Centers that originally had to communicate with all airports to measure performance can now obtain information from one location. AT management notes that interactions between controllers and supervisors have increased, allowing increased knowledge sharing and development of lasting professional relationships.

Finding 20: Additional requirements resulting from the events of September 11th have put a strain on the Potomac Consolidated TRACON controller workload.

Since September 11th, the Potomac Consolidated TRACON's requirements to oversee the restricted airspace have multiplied. However, the Potomac Consolidated TRACON, which was understaffed even before September 11th, was not provided with additional staffing to meet these new airspace requirements. As a result, the Potomac Consolidated TRACON is severely understaffed, putting a strain on the TRACON's controller workload.

Recommendation

4. Chief Operating Officer of the Air Traffic Organization (ATO) should ensure that the Potomac Consolidated TRACON is adequately staffed to meet the increased restricted airspace demands resulting from the events of September 11th.

RESULTS SUMMARY

In summary, the evaluation addressed how well the three consolidated TRACONs at Atlanta, Northern California, and the Baltimore/Washington/Virginia Tri-State (Potomac) area have achieved the cost and operational benefits that were expected. The evaluation team compared the benefits described in the cost benefit analyses performed for each proposed consolidation with those realized at the completed facilities.

There are distinct differences among the Atlanta, Northern California, and Baltimore/Washington/Virginia Tri-State (Potomac) area TRACON consolidations. These differences, which include airspace complexity, number of TRACONs within each consolidation effort, and the degree of Congressional or Agency project support, allowed for a limited number of general findings. Although it appears that the two consolidated TRACONs that received Agency Charters or Congressional mandates adhered better to the cost benefit analysis budget and schedule, the information concerning this matter was not conclusive. Additionally, the two consolidated TRACONs that are based on multiple major airports and complex airspace showed more anticipated employee and user benefits. As a result, the evaluation team presented the findings regarding the realization of expected benefits for each facility separately.

Atlanta Consolidated TRACON: The evaluation team found that the Atlanta Consolidated TRACON did not meet its scheduling goals, though it had an FAA Charter, as it was commissioned nine months behind schedule. The Charter did facilitate the TRACON in meeting its F&E cost goals. The consolidation was completed within budget, as F&E costs were 23 percent lower than planned. As a result of the 1998 NATCA Agreement and Pay Rule 59, the Atlanta Consolidated TRACON O&M staffing costs for FY 2003 were 53 percent higher than planned. Many of the expected benefits were not successfully attained at the TRACON. The operations to date at the Atlanta Consolidated TRACON are better characterized as a co-location rather than a true consolidation. Training and certifying AT controllers from the Macon and Columbus TRACONs have been more difficult than anticipated since as many as 70 percent of those facilities' controllers may fail to qualify on the Atlanta Consolidated TRACON airspace. Successful AF efforts that have resulted from TRACON consolidation could be threaten by AF personnel understaffing. Finally, because the planned fifth runway has not been completed, many of the user benefits originally identified in the cost benefit analysis have yet to be realized.

Northern California Consolidated TRACON: The Northern California Consolidated TRACON had neither a FAA Charter nor a Congressional Mandate, and, as a result, suffered two major budget cuts, which, together with automation problems, resulted in a 22-month delay in commissioning. Despite these setbacks, the TRACON was completed within budget, as F&E costs were six percent lower than planned. The effects of the 1998 NATCA Agreement and Pay Rules 51 and 59 prevented the TRACON from achieving its O&M staffing cost goals. In 2003,

O&M staffing costs which are 15 percent higher than expected, due to several factors, including reverse-commute costs. The TRACON is beginning to realize user benefits as a result of the consolidation of airspace as evidenced by a reduction in departure delays, and it anticipates further benefits with the implementation of Mosaic. The Northern California Consolidated TRACON has been very successful in the consolidation of work functions into a single facility, which has led to an increasingly productive work environment.

Potomac Consolidated TRACON: In 1998, Congress directed the FAA to complete the consolidation project at Potomac without further delay. Despite this mandate, the Potomac Consolidated TRACON not completed on schedule. The TRACON was commissioned seven months behind schedule due to the delay caused by the unavailability of STARS. The TRACON F&E costs were 46 percent higher than planned due primarily to a substantial increase in building size. The lower than expected staffing costs were due primarily to lower AF staffing costs despite increases in AT staffing costs of 24 percent. The higher AT staffing costs resulted from the effects of the 1998 NATCA Agreement and Pay Rule 59. Significant user benefits have yet to be realized at the Potomac Consolidated TRACON due to delays in airspace implementation; however, consolidation of functions into one facility has greatly improved communication among staff.

OVERALL RECOMMENDATIONS

Overall, we recommend that the ATO ensure that:

1. All future Investment Analysis cost benefit studies include an operational and cost baseline sufficiently detailed to assist in future management decisions. The operational baseline will specify how benefits will be derived while the cost baseline will summarize and present cost data in the same format as FAA records its incurred costs. These recommendations are meant to ensure that all actual collected costs and benefits can be matched to the baseline for comparability and evaluation.

2. Controllers in all consolidated TRACONs are properly trained and qualified to improve workforce flexibility and cohesion.

3. The newly-structured ATO's vice presidents for future consolidated TRACONs have more control over the Joint Resources Council approved cost baseline. Therefore, TRACON managers can avoid cost and schedule impacts caused by budget cuts, allowing them to quickly and efficiently address variances in equipment solutions, facility and employment requirements, and other unplanned changes.

4. Candidates for controller positions at future consolidated efforts are properly screened to determine ability to qualify on new consolidated facility airspace. This will help to avoid the additional costs associated with moving and training employees who later are unable to be certified.

5. The current AF staffing and training standards requirements should be reviewed to ensure that there is proper and timely AF staffing at consolidated facilities.

APPENDIX A: ACRONYMS/ABREVIATIONS

AF	Airway Facility
ARTS IIIE	Automated Radar Terminal System IIIE
AT	Air Traffic
ATO	Air Traffic Organization
CIP	Capital Investment Plan
FAA	Federal Aviation Administration
F & E	Facilities and Equipment
NAS	National Airspace System
NATCA	National Air Traffic Controllers Association
O & M	Operational and Maintenance
PCS	Permanent Change of Station
STARS	Standard Terminal Automation Replacement System
TRACON	Terminal Radar Approach Control

APPENDIX B: LIST OF LOCATIONS AND DESIGNATORS OF THE INDIVIDUALS INTERVIEWED

In determination of user benefits and opinions, a 30-point questionnaire was created to gather qualitative data surrounding TRACON consolidations in the Atlanta, Northern California and Potomac areas. The following is the locations and designator of the individuals interviewed. Interviewees' responses were included in this report:

Interviewee List	
Location	**Designator**
Atlanta Consolidated TRACON	
Region	FAA Southern Region Headquarters
Region	FAA Southern Region Headquarters
Region	NAS Implementation Program/FAA Southern Region Headquarters
Region	FAA Southern Region Headquarters
Region	FAA Southern Region Headquarters
Region	FAA Southern Region Headquarters/NISC
Region	FAA Southern Region Headquarters
Atlanta Consolidated TRACON	Communications
Atlanta Consolidated TRACON	AF
Atlanta Consolidated TRACON	Administration
Atlanta Consolidated TRACON	AT
Atlanta Consolidated TRACON	Operations
Atlanta Consolidated TRACON	AF FMO
Northern California Consolidated TRACON	
Northern California Consolidated TRACON	AT Mgr
Northern California Consolidated TRACON	Personnel
Region	AWP-507
Northern California Consolidated TRACON	Airspace
Contractor	Former TRACON AF Manager
Northern California Consolidated TRACON	AF
Northern California Consolidated TRACON	AF
Potomac Consolidated TRACON	
The Potomac Consolidated TRACON	AT Operations
The Potomac Consolidated TRACON	AT
The Potomac Consolidated TRACON	AF
Headquarters	
Terminal Facilities Branch of the Terminal Business Unit	Manager
Terminal Facilities Branch of the Terminal Business Unit	Analyst
Contractor	Analyst
Contractor	Cost Benefit Analysis Developer
Contractor	Analyst

APPENDIX C: ANALYSIS OF FINANCIAL BENEFITS

To determine the realization of financial benefits, costs proposed on the original Cost Benefit Analysis performed for each of the three consolidated TRACONs were compared with the costs actually incurred for both Facilities and Equipment (F&E) and Operations and Maintenance (O&M).

Atlanta Consolidated TRACON

F & E	Budget	Actual	Difference
Facilites	$32,622,650	$47,377,975	-$14,755,325
Equipment	$38,793,354	$24,756,472	$14,036,882
Other	$30,593,879	$24,078,938	$6,514,941
Total F&E	$102,009,883	$96,213,385	$5,796,498
O&M (2003)			
AF Staffing	$7,262,559	$4,839,428	$2,423,131
AT Staffing	$27,714,131	$35,419,089	-$7,704,958

Table C.1: Budget v. Actual Cost Comparison - Atlanta

Table C.1 shows the comparison between cost benefit analysis estimates and actual costs incurred during the Atlanta Consolidated TRACON consolidation. Overall, Atlanta F&E costs were 23 percent below budget while O&M costs were 53 percent above budget. Increased O&M costs can be attributed to a doubling of AT staffing costs.

Table C.2 is a detailed comparison of planned versus actual F& E costs in Atlanta with explanations for cost variance greater than $1 million.

ATLANTA	CBA (Escalated Then-Year $)	Incurred	Difference	Comments
Facility Costs				
A&E and Site Adapt	1,900,000	1,566,317	333,683	Includes Sverdrup support
Environmental Impact Survey	309,000	300,000	9,000	
Land	1,273,000	873,000	400,000	
Construction	19,501,411	17,695,424	1,805,987	Construction less expensive per sf than anticipated
Power	4,321,880	6,292,480	(1,970,600)	Build size increase from 78,000 to 89,000 sf required more power
Furniture Including controller chairs	896,260	950,000	(53,740)	
Electronic/Office Equipment/GSA	601,150	0	601,150	
Decommissioning of current facilities	337,800	0	337,800	
Total Facility Costs Escalated ("then-year")	29,140,501	27,677,221	1,463,280	
Equipment				
Admin LAN	601,150	0	601,150	
Admin Voice Switch	601,150	352,500	248,650	
ASOS CVD Display	98,370		98,370	
Automation System	1,748,800	5,089,336	(3,340,536)	Automation orignally not in A80 budget
Automation System Displays	8,312,265		8,312,265	Funded by ATB200
Digitizers	1,093,000	120,000	973,000	Didn't go digital
DVRS	96,184	82,500	13,684	
ETMS	327,900	224,545	103,355	
ETVS	1,202,300	1,535,954	(333,654)	Bought 2 RDVS including training switch; includes voice switch by-pass and voice switch & control system (VSCS) circuit (VTABS) for center
ETVS training switch	437,200		437,200	
FDIO	114,590	145,251	(30,661)	
IDS Interfaces	65,580	0	65,580	
IDS Displays	217,835	1,750,914	(1,533,079)	A80 bought ACE IDS equipment
LLWAS Relocate	72,138		72,138	
Mode S	0	0	0	
MWP Briefing Terminal	194,554	0	194,554	
MSAW Display	21,860	0	21,860	
Ops Consoles	442,665	1,869,310	(1,426,645)	Updated equipment
RVR Display	38,255	0	38,255	
SCIP	1,093,000	0	1,093,000	A80 acquired asset at no cost
Telecommunications	9,457,349	4,507,730	4,949,619	F&E includes RCE, RCE racks, MDT terminal; DMN
TDWR Relocate	12,367	0	12,367	
UHF/VHF	546,500	0	546,500	
Headsets		32,390	(32,390)	
EFSTS Sustainment		175,000	(175,000)	
CBI Equipment		19,800	(19,800)	
Total Equipment Escalated ("then-year")	26,795,012	15,905,230	10,889,782	
Other F&E				
Airspace Analysis	3,235,800	1,434,218	1,801,582	Origanally estimate based on more rigorous analysis
Site Integration, T&E	3,571,850	595,000	2,976,850	Includes logistics support, test & measuring equipment; Schedule A/B
Contract Support & Systems Engineering	7,117,700	12,208,561	(5,090,861)	Increased contracted requirements
Permanent Change of Station	2,951,100	3,257,082	(305,982)	Result of Local MOU
Other: STARS Program Support (training)	753,120	50,000	703,120	
	700,000		700,000	Inquiring source of the $ 700,000
Mgmt Reserve	4,828,470		4,828,470	Funds used eslewhere on project
Total Other F&E Escalated ("then-year")	23,158,040	17,544,861	5,613,179	
Total F&E Escalated	**79,093,553**	**61,127,312**	**17,966,241**	

Table C.2: Detailed F&E Costs Budget v. Actual – Atlanta

Northern California Consolidated TRACON

F & E	Budget	Actual	Difference
Facilites	$32,622,650	$47,377,975	-$14,755,325
Equipment	$38,793,354	$24,756,472	$14,036,882
Other	$30,593,879	$24,078,938	$6,514,941
Total F&E	$102,009,883	$96,213,385	$5,796,498
O&M (2003)			
AT Staffing	$27,714,131	$35,419,089	-$7,704,958
AF Staffing	$7,262,559	$4,839,428	$2,423,131

Table C.3: Budget v. Actual Cost Comparison – Northern California

Table C.3 shows the comparison between cost benefit analysis estimates and actual costs incurred during the Northern California TRACON consolidation. Overall, F&E costs were within budget despite facilities costs running 45 percent higher than estimated. O&M costs in 2003 were above budget due to AT staffing costs running 28 percent higher than estimated.

Table C.4 is a detailed comparison of planned versus actual F& E costs in Northern California with explanations for cost variance greater than $1 million.

NORTHERN CALIFORNIA	CBA (Escalated Then-Year $)	Incurred Expenditures	Difference	Comments
Facility Costs				
A&E	783,169	2,458,467	(1,675,298)	Change to Sverdrup building planning and design
Site Adaptation	843,570		843,570	
EIS	206,000	140,000	66,000	
Site Preparation	2,652,250	3,708,046	(1,055,796)	Greater site development and grading required than proposed
Regional Land Acquisition Sup.	40,000	65,900	(25,900)	BOR land purchase
Construction	18,227,850	24,943,685	(6,715,835)	Original estimate on 86,000 sf design; Actual 95,000 sf.
Power (DRPDS)	5,365,975	7,291,024	(1,925,049)	Power requirements increase with increase in building.
Furniture	1,526,865	1,004,580	522,285	Includes controller chairs, audio visual equipment
Electronic Equipment	2,251,018	2,368,686	(117,668)	Includes installation materials for NCT and remote sites
GSA Supplies	146,316		146,316	
Closing/Decommissioning	579,637	502,220	77,417	
Utilities, Building/Grounds, Guard Services, Janitorial		3,163,086	(3,163,086)	Sustain costs, due to delay in commissioning of facility
Recurring Telecomm		1,732,281	(1,732,281)	New requirements
Total Facility Costs (in then year)	**32,622,650**	**47,377,975**	**(14,755,325)**	
Equipment (& Quantities)				
STARS (1 Large)	1,812,069	3,440,000	(1,627,931)	$3M for mosaic software
Displays (52/6)	11,520,708		11,520,708	Funded by ATB200
ETMS (1)	337,653	452,948	(115,295)	
FDIO (6)	114,802	65,229	49,573	
DVRS (267 channels)	390,552	128,335	262,217	
Tech MDT (12)	30,389		30,389	
MCC & MDT (4)	459,208		459,208	
IDS-4 (67)	2,885,332	2,374,480	510,852	Acquired ACE IDS
DASI (7)	213,372		213,372	
Digitizers (3)	6,647,030		6,647,030	NCT did not fund solution for digitizers
RCE (134 channels)	995,400	814,248	181,152	
RVR Displays (14)	99,270		99,270	
Telecommunications	8,233,777	10,397,794	(2,164,017)	More requirements for larger building
ETVS (138 positions)	4,336,844	2,302,500	2,034,344	Acquired RDVS; includes Voice Switch By-Pass
FAATSAT	0		0	
Administrative LAN (1)	373,669		373,669	
Consoles/Shrouds	343,280	424,224	(80,944)	
SCIP		90,000	(90,000)	SCIP parts
EFSTS		150,000	(150,000)	
Digitizer Mod		92,000	(92,000)	
Headsets		50,425	(50,425)	
ECMS Fix		296,000	(296,000)	
Area Displays (6)		550,000	(550,000)	
Electronic Data Management System		60,000	(60,000)	
TSM-2500		105,646	(105,646)	
RAPPI/ERIT		100,000	(100,000)	
Test & Measuring Equipment		429,055	(429,055)	
Schedule A/B		895,000	(895,000)	
RTR		1,289,588	(1,289,588)	Establishment at NCT and Antenna
Phase 4 Comm (remote sites)		249,000	(249,000)	
Total Equipment (in then year)	**38,793,354**	**24,756,472**	**14,036,882**	
Other F&E				
Airspace Study	2,154,568	424,893	1,729,675	ATAC Contract
Contract Support & SE	8,742,525	7,563,811	1,178,714	Region Contract, Engineering Support, TSSC,
FAA Support	2,205,945	331,279	1,874,666	Power Study; Tech Center
Headquarters Support	7,004,055	2,714,811	4,289,244	Volpe, NISC, ARN30 Logistics Support
Temporary Office Costs	494,095		494,095	
Temporary Storage & Equip.	339,641		339,641	
PCS	9,653,050	12,994,144	(3,341,094)	Per BXM 11/11/03 PCS funds FY98-02 made
Other: STARS Program Support (training)		50,000	(50,000)	
Total Other F&E (in then year)	**30,593,879**	**24,078,938**	6,514,941	
Total F&E (in then year)	**102,009,883**	**96,213,385**	5,796,498	

Table C.4: Detailed F&E Costs Budget v. Actual – Northern California

Potomac Consolidated TRACON

F & E	Budget	Actual	Difference
Facilites	$23,506,000	$44,514,759	-$21,008,759
Equipment	$21,842,568	$28,605,416	-$6,762,848
Other	$27,340,345	$32,698,990	-$5,358,645
Total F&E	$72,688,913	$105,819,165	-$33,130,252
O & M (2003)			
AF Staffing	$12,480,600	$5,205,557	$7,275,043
AT Staffing	$23,032,140	$28,505,908	-$5,473,768

Table C.5: Budget v. Actual Cost Comparison – Potomac

Table C.5 shows the comparison between cost benefit analysis estimates and actual costs incurred during the Potomac TRACON consolidation. Overall, F&E costs were above budget due to the doubling of facilities costs compared to estimates. O&M costs were within budget despite AT staffing costs running 24 percent higher than estimated.

Table C.6 is a detailed comparison of planned versus actual F& E costs in Potomac with explanations for cost variance greater than $1 million.

POTOMAC	CBA (Escalated Then-Year $)	Incurred	Difference	Comments
FACILITY COSTS				
Building EIS	200,000		200,000	
Site Adapt	1,421,784	1,620,392	-198,608	Sverdrup work; also environmental assessment EDDA
Land Acquisition	2,058,000	1,666,020	391,980	
Land Modifications	926,100	0	926,100	
Power System	4,442,760	4,641,481	-198,721	
Construction	12,533,026	29,691,028	-17,158,002	Incl Sverdrup design ECPs, guardshack mod; roof deflection study/work
Furniture	625,345	1,230,561	-605,216	Includes controller chairs
Electronic Equip & GSA	947,785	1,888,572	-940,787	Voice Data equip: phone, copiers, faxes (AV Washington)
Facility Decommissioning	351,200	485,757	-134,557	
Facility Maintenance, Guard, Etc.		3,290,948	-3,290,948	Higher costs resulting from larger facility
Total Facilities Escalated "Then Year"	**23,506,000**	**44,514,759**	**-21,008,759**	
EQUIPMENT COSTS			0	
STARS	11,488,598	1,000,000	10,488,598	Went with different Automation System
STARS Displays	0		0	
FDIO	55,566	129,036	-73,470	
CTAS	574,600	0	574,600	
Automated drop tube	100,611		100,611	
ETMS	344,760	255,125	89,635	
ATOMS	11,179	0	11,179	
IDS Displays	288,215	3,930,159	-3,641,944	Procured ACE IDS
IDS Interfaces	19,084		19,084	
ETVS	1,855,714	757,069	1,098,645	Procured RDVS; rebuild RDVS at PCT
DVRS	136,384	1,947,999	-1,811,615	Includes upgrades
DSRCE	415,859	1,334,706	-918,847	Includes channel banks
ECS	111,790	2,302,494	-2,190,704	Includes radios for ECS
Admin LAN	271,850	160,000	111,850	
MMS Terminal	21,748	0	21,748	
SCIPS	335,370	1,889,964	-1,554,594	Includes emulator; BAE 8-yr contract
RVR Displays	101,729	0	101,729	
Telecommunications	5,094,666	7,437,470	-2,342,804	Includes DMN, LINCS EUL Node, ACE IDS circuits at remote ATCTs
VTS	614,845		614,845	
Other:			0	
Supplies, Equipment & Maintenance (WBS 3.3.5)		750,000	-750,000	
Consoles (incl TSSC design)		1,973,219	-1,973,219	New requirement
Dulles ICSS Voice Switch Mod		147,964	-147,964	
RIFRS		72,760	-72,760	
BWM		1,959,085	-1,959,085	New Requirement
Radios		282,879	-282,879	25 VHF/5 UHF etc
Area Displays		933,583	-933,583	
Headsets		8,793	-8,793	
Time Code Displays		68,250	-68,250	
IC Camera		13,500	-13,500	
Test & Measureing Equipment (tools)		1,133,361	-1,133,361	New requirement
Consolidation of ADW into DCA		118,000	-118,000	
Total Equipment Escalated "Then Year"	**21,842,568**	**28,605,416**	**-6,762,848**	
Other F&E				
PM Support	9,070,632	5,734,192	3,336,440	Overestimated requirement
Contract Support & SE	6,272,372	1,407,553	4,864,819	Region support/ANI (A&E)
Site Integration, T&E	2,620,747	2,966,178	-345,431	TSSC, Tech Center (ACT), OATS Tech Spt (WBS2.2.2), CAD work; SAIC ITOP
Leased Office Space	624,796	1,773,667	-1,148,871	Includes telcomm support for relocation; Herndon furniture; Vint Hill lease and support equip/telecomm; HAZMAT Storage building; PCT wharehouse space
Airspace Study	2,699,575	6,720,288	-4,020,713	SCATS/CROWN airspace (WBS 2.2.2); TAAM (Preston Gp); H/W tools; NIRS; noise modeling;UFA AT Model; VIS TEIS
Airspace EIS	158,710	3,944,350	-3,785,640	Includes PRC EIS Tier II, and environmental OSHA Compliance (zero expenditures)
PCS	3,171,792	8,810,425	-5,638,633	Per BXM 10/1/03 PCS funds FY97, 00-02 made available $ 9,556,309
Management Reserve	2,721,721		2,721,721	
Other:				
ALCATEL voice data Equip		1,342,337	-1,342,337	New Requirement
Total Other F&E Escalated "Then Year"	**27,340,345**	**32,698,990**	**-5,358,645**	
Total F&E	**72,688,913**	**105,819,165**	**-33,130,252**	

Table C.6: Detailed F&E Costs Budget v. Actual -Potomac

Summary

Generally, actual costs incurred at the three consolidated TRACONs, the Atlanta Consolidated TRACON, Northern California Consolidated TRACON, and Potomac were within the acceptable range of the cost benefit analysis estimates in most cost categories. Major exceptions at each location were Facilities and AT staffing costs. All three TRACON buildings ultimately were significantly larger than cost benefit analysis estimates, accounting for increased Facility costs; AT staffing cost increases resulted from the effects of the NATCA agreement and several Pay Rules that were enacted after the performance of the Cost benefit analyses.

APPENDIX D: USER BENEFITS - METHODOLOGY AND DATA COLLECTION RESULTS FOR DEPARTURE DELAYS

When considering TRACON consolidation, Atlanta, Potomac, and Northern California predicted benefits, both financial and operational, from the current state. Operational benefits include: controller productivity, efficient aircraft operations, pilot productivity, safety, capacity and technology. Among these benefits, the evaluation team focused on reduction in departure delays, as it was most quantifiable. Arrival delays were not included in the analysis as too many factors, outside of the given airport, affect delay statistics.

The objective of reviewing delay data, pre and post consolidation was to determine if stakeholders had received the intended benefits – decreased delays – as a result of the consolidation. To do so, the team collected delay data from the Aviation System Performance Metrics database to compare operations prior to consolidation with those following consolidation.

Dates for data collection were based on the consolidation dates of each TRACON in order for accurate pre versus post delay analysis. Table D.1 indicates the dates used for analysis:

TRACON	Consolidation Date	Data Collection Period
Atlanta	April 2001	June, July, August (1998-2003)
Northern California	August 2002	April, May, June (2002-2003)
Potomac	December 2002	June, July, August (2002-2003)

Figure D.1: Dates for Data Collection

Consistency of volume in the summer months led to collection of June – August data. As the Northern California Consolidated TRACON was complete in August, April – June data was collected to more accurately compare pre and post consolidation. As Atlanta's consolidation date was early (2001), data was collected for three years prior to consolidation in comparison with three years following consolidation. Since Northern California and Potomac were consolidated in 2002, data was collected one year prior to consolidation in comparison to one year following consolidation.

In collecting data, the team found that all airports within the TRACONs were not represented in Aviation System Performance Metrics. Therefore, analysis was performed on those airports with accessible data. Table D.2 indicates those airports that were used for analysis:

TRACON	Consolidated Airports	Airports for Analysis
Atlanta	▪ Atlanta ▪ Columbus ▪ Macon	▪ Atlanta
Northern California	▪ Oakland ▪ San Francisco ▪ San Jose ▪ Sacramento ▪ Monterey ▪ Stockton ▪ Travis AFB	▪ Oakland ▪ San Francisco ▪ San Jose
Potomac	▪ Baltimore-Washington ▪ Reagan National ▪ Dulles ▪ Andrews AFB ▪ Richmond	▪ Baltimore-Washington ▪ Reagan National ▪ Dulles

Figure D.2: Airports Used in Analysis

The following daily delay data was collected for each airport:

- Date
- Total Departures
- Delayed Departures
- Percent Delayed Departures
- Average Minutes per Delayed Departure

Using this data, the team compared pre-consolidation data with post-consolidation data.

Atlanta Consolidated TRACON

Table D.3 is an example of the comparison of Atlanta delay data.

	2000			2001			Difference		
	June	July	August	June	July	August	June	July	August
Total Departures	34368	34514	35701	33610	35221	35873	-758	707	172
Departure Delays	11138	10074	9121	11449	9739	8791	311	-335	-330
Percent Departure Delays	32.41%	29.19%	25.55%	34.06%	27.65%	24.51%	1.66%	-1.54%	-1.04%
Average Minutes per Delay	52.28	51.17	48.01	50.92	46.37	46.00	-1.36	-4.80	-2.01

Figure D.3: Atlanta Delay Analysis – 2000 v. 2001

Delays in Atlanta remained fairly consistent between 2000 and 2001; however, delays decreased significantly between 2000 and 2002. Atlanta was still in the start-up period in 2001 but reached full operation in 2002. Table D.4 illustrates this decrease.

	2000			2002			Difference		
	June	July	August	June	July	August	June	July	August
Total Departures	34368	34514	35701	34144	34829	35757	-224	315	56
Departure Delays	11138	10074	9121	8240	8334	6091	-2898	-1740	-3030
Percent Departure Delays	32.41%	29.19%	25.55%	24.13%	23.93%	17.03%	-8.27%	-5.26%	-8.51%
Average Minutes per Delay	52.28	51.17	48.01	45.52	45.95	40.00	-6.77	-5.23	-8.02

Figure D.4: Atlanta Delay Analysis – 2000 v. 2002

Cost savings from this reduction in delay was calculated as a savings of $24.83 per minute of delay. This accounted for a total of nearly $10 million by 2003. Table D.5 indicates the accrued annual cost savings since consolidation in April 2001.

	Total Departures (Jun-Aug)	Total Average Minutes of Departure Delay (Jun-Aug)	Delay Minutes Delta (compared with 2000 pre-consolidation period)	Economic Benefit from Delay Avoidance ($24.83 per minute of departure delay)
2000	104,583	1,535,790		
2001	104,704	1,439,020	(96,769.51)	$2,402,787.00
2002	104,730	1,001,615	(534,175.43)	$13,263,575.82
2003	109,478	1,134,477	(401,312.60)	$9,964,591.74

Figure D.5: Atlanta Cost Savings – Delay Reduction

Trends of the delay data illustrate a slight decrease in percent delay in 2001 versus a significant decrease in 2002. In Figures D.6 and D.7 this decrease is apparent by the increased gap between the 2000 and 2002 trend lines.

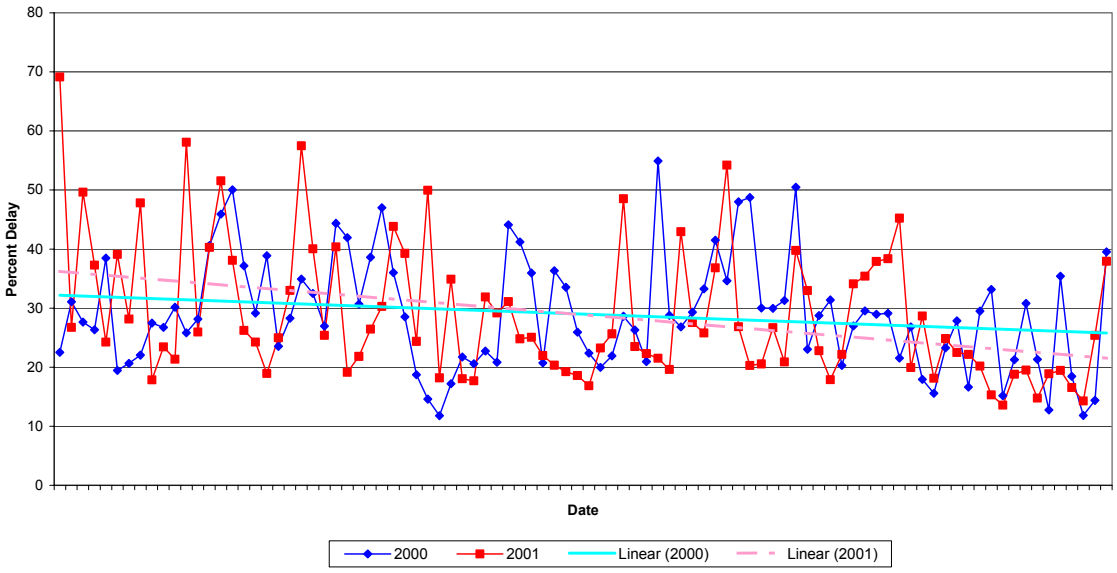


Figure D.6: Percent Departure Delay Atlanta - 2000 v. 2001
Summer Months (June, July, August)

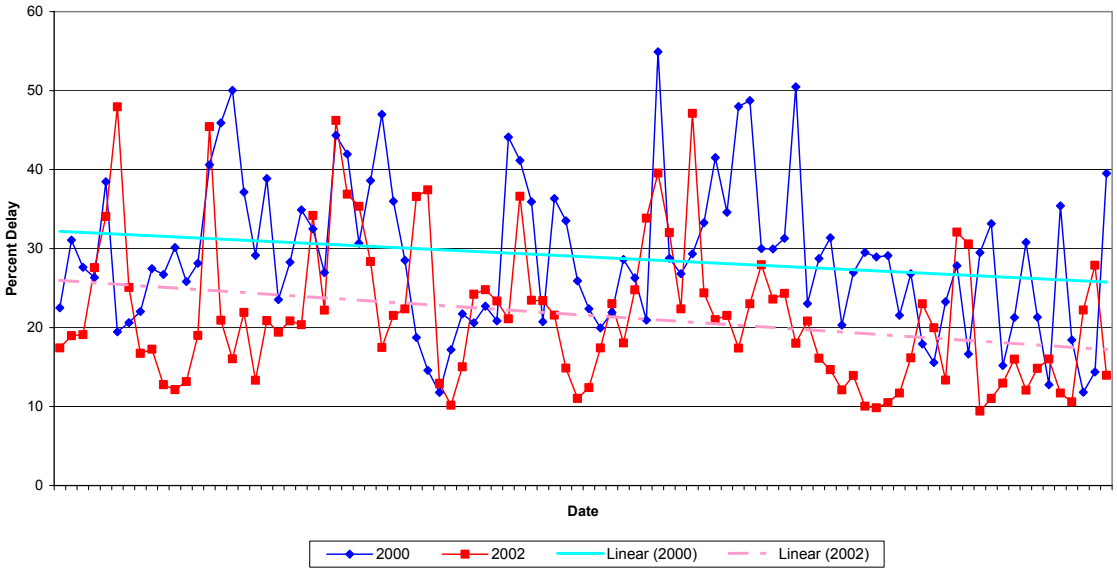


Figure D.7: Percent Departure Delay Atlanta - 2000 v. 2002
Summer Months (June, July, August)

Similarly, a significant decrease can be seen in average minutes per delay from 2001 to 2002.

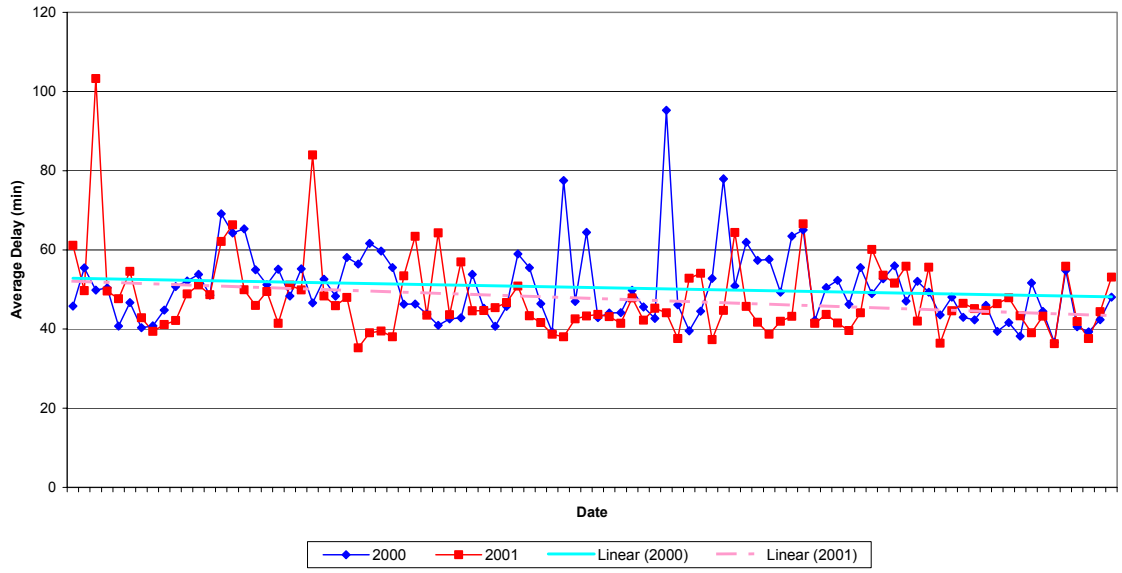


Figure D.8: Average Departure Delay Atlanta - 2000 v. 2001 Summer Months (June, July, August)

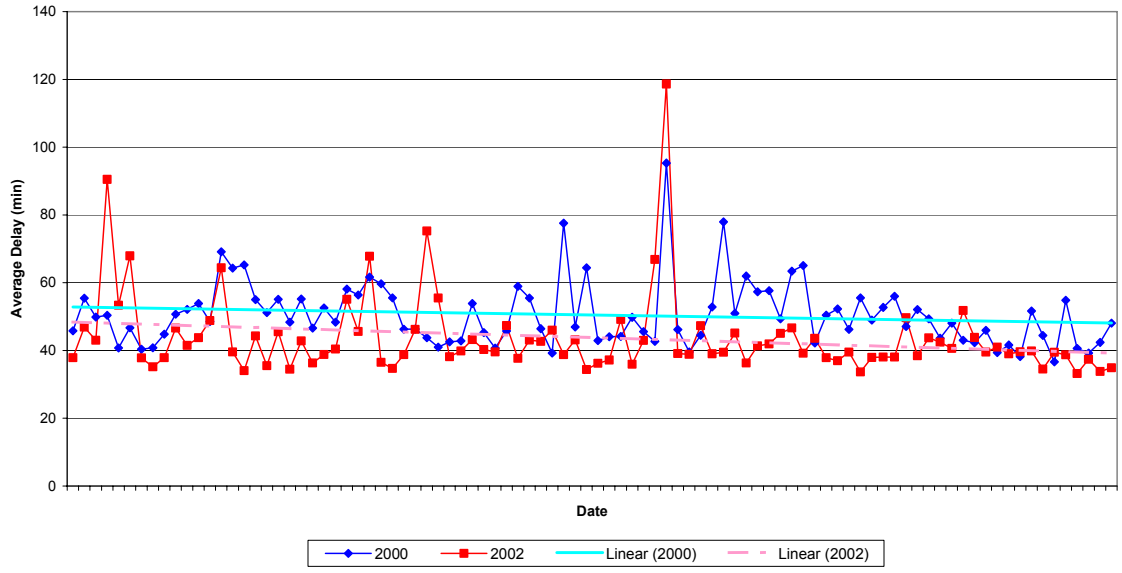


Figure D.9: Average Departure Delay Atlanta - 2000 v. 2002 Summer Months (June, July, August)

Northern California Consolidated TRACON

Figures D.10 – D.12 compare Oakland, San Francisco and San Jose delay data for April, May and June of 2002 and 2003. Percent delays for each airport have decreased since consolidation; however average minutes per delay stayed fairly consistent.

	2002			2003			Difference		
	April	May	June	April	May	June	April	May	June
Total Departures	7061	7408	7255	7066	7087	7004	5	-321	-251
Departure Delays	1552	1624	1782	880	772	1085	-672	-852	-697
Percent Departure Delays	21.98%	21.92%	24.56%	12.45%	10.89%	15.49%	-9.53%	-11.03%	-9.07%
Average Minutes per Delay	36.12	36.65	36.27	38.65	37.97	36.94	2.53	1.32	0.67

Figure D.10: Oakland Delay Analysis – 2002 v. 2003

	2002			2003			Difference		
	April	May	June	April	May	June	April	May	June
Total Departures	11352	11864	12018	11235	11588	11793	-117	-276	-225
Departure Delays	1586	1449	1846	1133	1295	1482	-453	-154	-364
Percent Departure Delays	14%	12%	15%	10%	11%	13%	-3.89%	-1.04%	-2.79%
Average Minutes per Delay	43	42	47	48	47	47	4.56	5.26	0.62

Figure D.11: San Francisco Delay Analysis – 2002 v. 2003

	2002			2003			Difference		
	April	May	June	April	May	June	April	May	June
Total Departures	6508	6636	6411	6033	5994	6114	-475	-642	-297
Departure Delays	1282	1046	1230	742	672	989	-540	-374	-241
Percent Departure Delays	20%	16%	19%	12%	11%	16%	-7.40%	-4.55%	-3.01%
Average Minutes per Delay	37	38	40	41	42	41	4.399	4.053	1.031

Figure D.12: San Jose Delay Analysis – 2002 v. 2003

Combined, these three airports yielded a cost savings of over $3.5 million, Oakland contributing the most with nearly $2 million, followed by San Jose with approximately $900,000, and San Francisco with approximately $750,000. Cost saving were calculated using a savings of $24.83 per minute of delay. Figure D.13 depicts the cost savings after less than one year of consolidation.

	Total Departures (Apr-Jun)	**Total Average Minutes of Departure Delay (Apr-Jun)**	**Delay Minutes Delta**	**from Delay Avoidance ($24.83 per minute of departure delay)**
2002	76,513	532,003		
2003	73,914	388,201	(143,802)	$3,570,605.22

Figure D.13: Northern California Cost Savings – Delay Reduction

Trend analysis illustrates a decrease in percent delays as the 2002 trend line appears below the 2003 line. The distance between the lines shows the magnitude of delay reduction. Figures D.13-D.16 show percent delay for Oakland, San Francisco and San Jose.

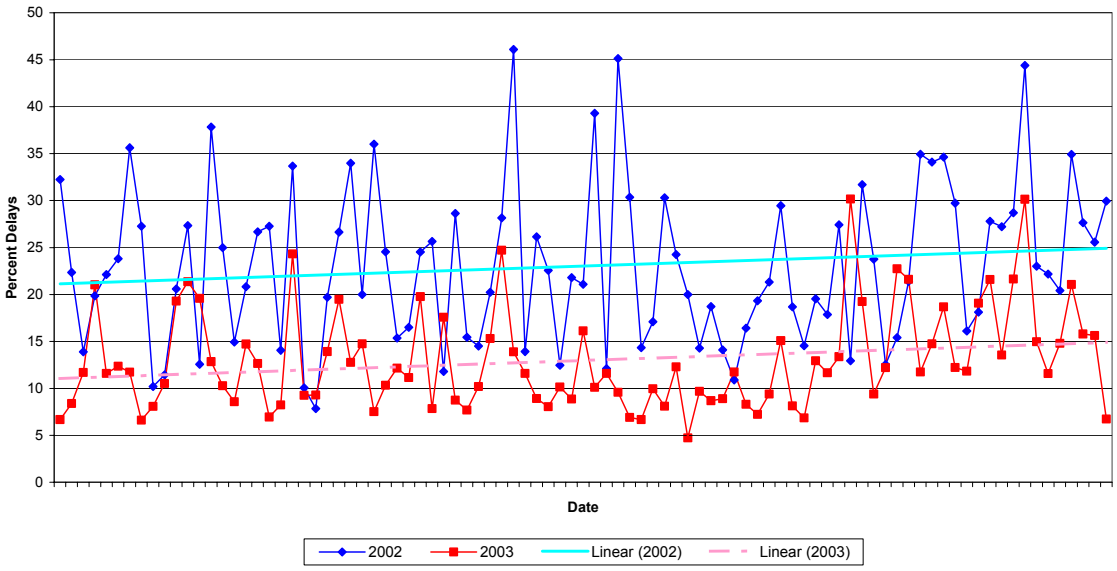


Figure D.14: Percent Departure Delay Oakland - 2002 v. 2003
April, May, June

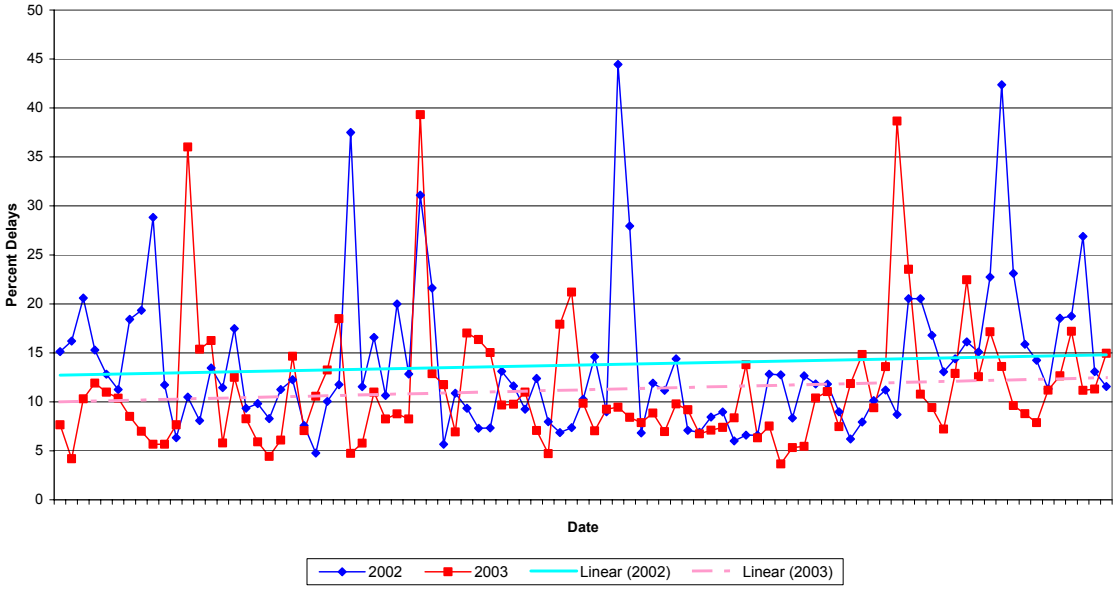


Figure D.15: Percent Departure Delay San Francisco - 2002 v. 2003
April, May, June

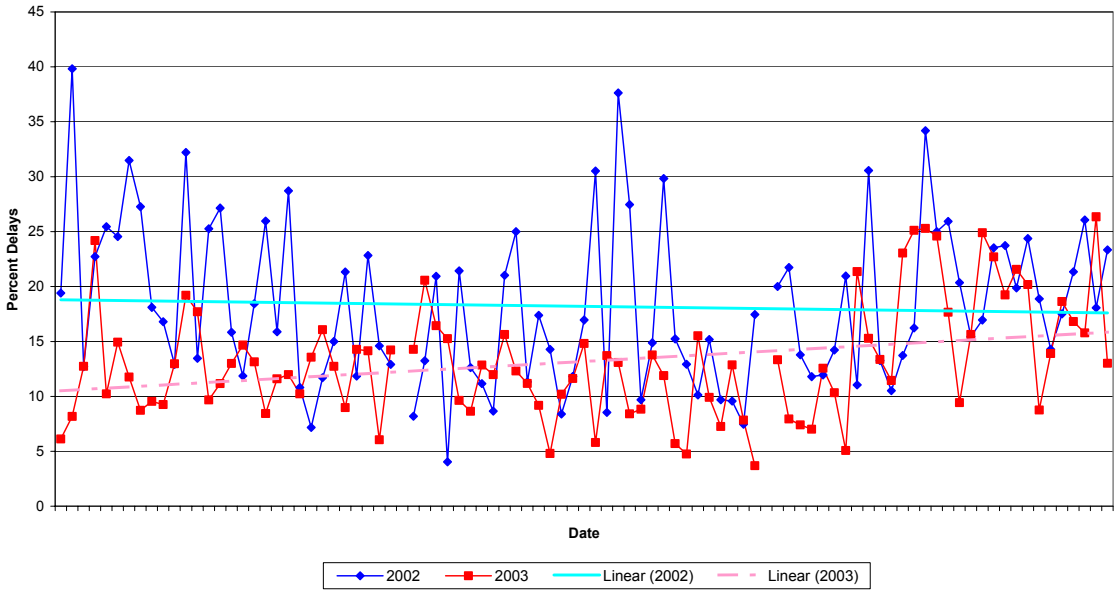


Figure D.16: Percent Departure Delay San Jose - 2002 v. 2003
April, May, June

Although total volume and percent of delays decreased, average minutes per delay increased slightly after consolidation. This increase is illustrated in Figures D.17 –D.19 by the 2003 trend line appearing above the 2002 line for all three airports. The distance between the lines indicates the slight magnitude of the increase.

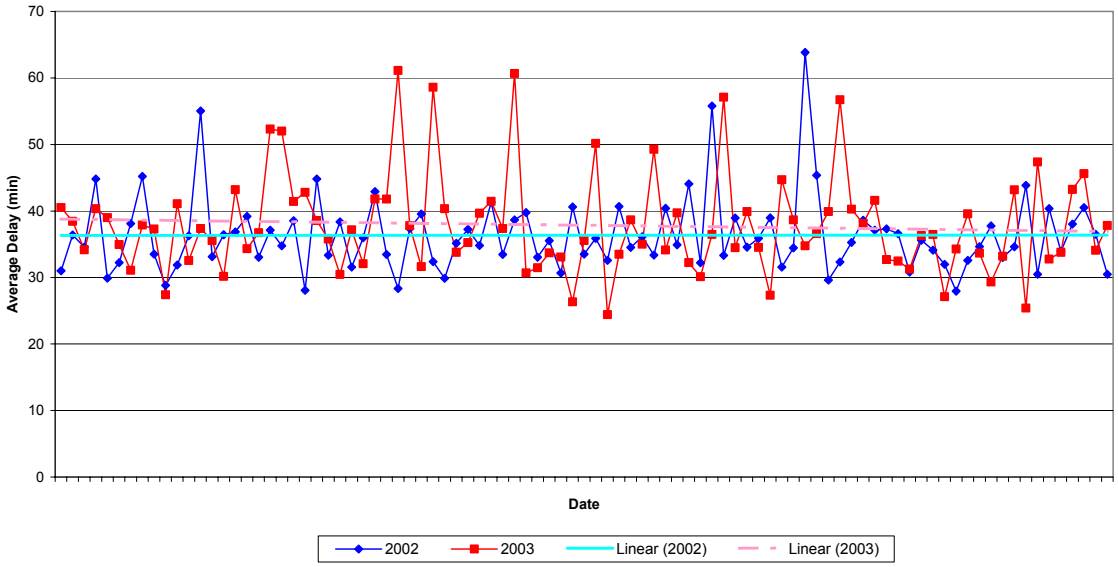


Figure D.17: Average Departure Delay Oakland - 2002 v. 2003
April, May, June

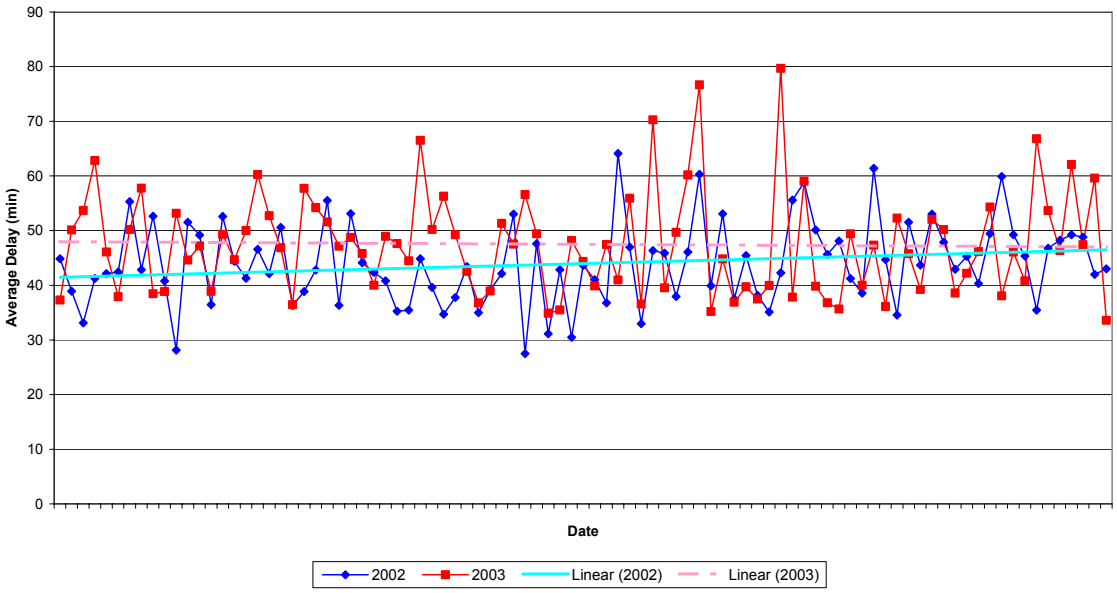


Figure D.18: Average Departure Delay San Francisco - 2002 v. 2003
April, May, June

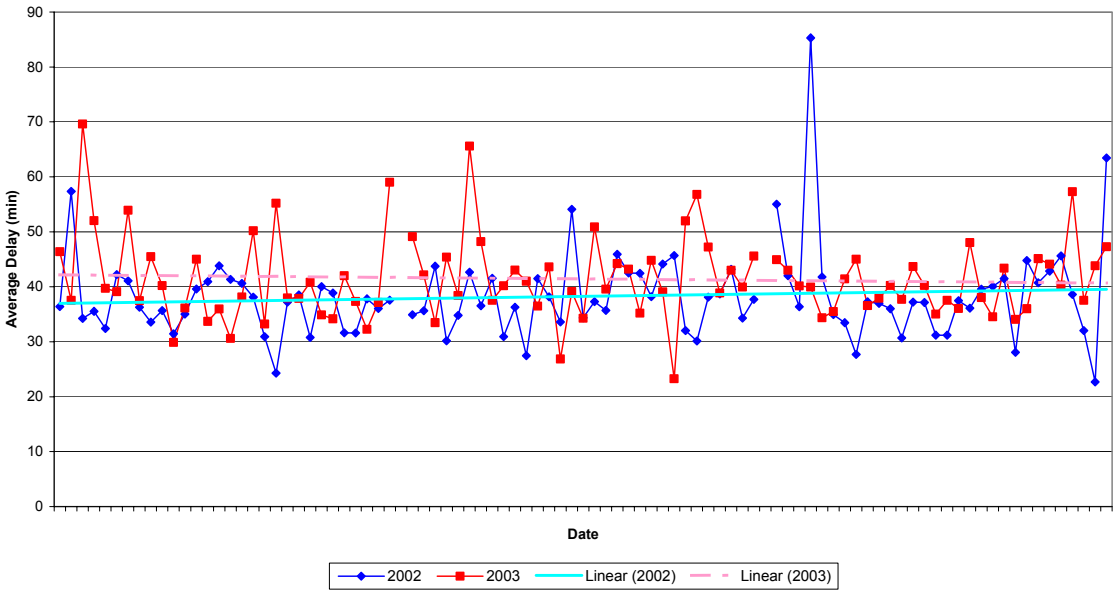


Figure D.19: Average Departure Delay San Jose - 2002 v. 2003
April, May, June

Potomac Consolidated TRACON

Figures D.20 through D.22 compare Baltimore-Washington, Reagan National, and Dulles airport delay data for June, July, and August of 2002 and 2003. Percent delays at each airport are directly related to number of departures. Baltimore Washington International Airport and Dulles showed a decrease in volume and a decrease in delays in 2003, whereas Reagan National showed an increase in volume as well as an increase in delays. Volume did not show an effect on minutes per departure delay as it remained consistent from 2002 to 2003. Potomac, however, initiated consolidation only six months prior to analysis dates. Atlanta showed similar numbers immediately after consolidation; however delays decreased significantly the following year.

	2002			2003			Difference		
	June	July	August	June	July	August	June	July	August
Total Departures	10769	10876	11005	10267	10563	10628	-502	-313	-377
Departure Delays	3123	2960	2450	1791	2161	2558	-1332	-799	108
Percent Departure Delays	29.00%	27.22%	22.26%	17.44%	20.46%	24.07%	-11.56%	-6.76%	1.81%
Average Minutes per Delay	47.65	45.27	44.81	43.96	49.59	50.39	-3.69	4.32	5.58

Figure D.20: Baltimore-Washington Delay Analysis – 2002 v. 2003

	2002			2003			Difference		
	June	July	August	June	July	August	June	July	August
Total Departures	8804	9251	9545	10442	10556	10543	1638	1305	998
Departure Delays	1246	1314	1294	1450	1462	1914	204	148	620
Percent Departure Delays	14.15%	14.20%	13.56%	13.89%	13.85%	18.15%	-0.27%	-0.35%	4.60%
Average Minutes per Delay	50.52	50.26	45.55	48.61	49.61	53.25	-1.90	-0.65	7.70

Figure D.21: Reagan National Delay Analysis – 2002 v. 2003

	2002			2003			Difference		
	June	July	August	June	July	August	June	July	August
Total Departures	11660	11797	12101	11004	11230	11158	-656	-567	-943
Departure Delays	2975	2437	2435	2236	2490	2558	-739	53	123
Percent Departure Delays	25.51%	20.66%	20.12%	20.32%	22.17%	22.93%	-5.19%	1.51%	2.80%
Average Minutes per Delay	52.52	48.09	48.32	49.45	53.92	53.18	-3.07	5.84	4.87

Figure D.22: Dulles Delay Analysis – 2002 v. 2003

Overall, Potomac TRACON realized a cost savings of approximately $770,000 due to delay reduction. This is despite the nearly $1.5 million loss by Reagan National Airport due to an increase in departure delays. Baltimore Washington International Airport saved close to $2 million while Dulles brought in over $250,000. Figure D.23 depicts the cost savings approximately six months after consolidation.

	Total Departures (Jun-Aug)	Total Average Minutes of Departure Delay (Jun-Aug)	Delay Minutes Delta	Economic Benefit from Delay Avoidance ($24.83 per minute of departure delay)
2002	73,927	971,614		
2003	96,391	940,635	(30,979)	$769,216.03

Figure D.23: Potomac Cost Savings – Delay Reduction

Trend analysis depicts a decrease in percent delays at Baltimore Washington International Airport, an increase at Reagan National and an initial decrease at Dulles. This is apparent by the trend lines in Figures D.24-D.26.

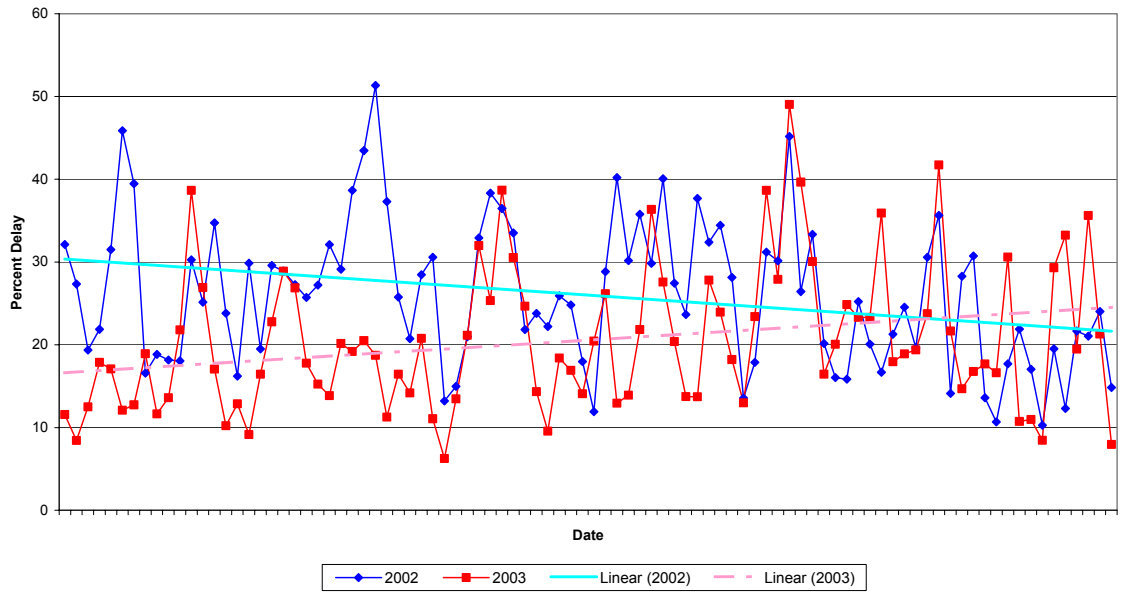


Figure D.24: Percent Departure Delay Baltimore Washington International Airport - 2002 v. 2003
Summer Months (June, July, August)

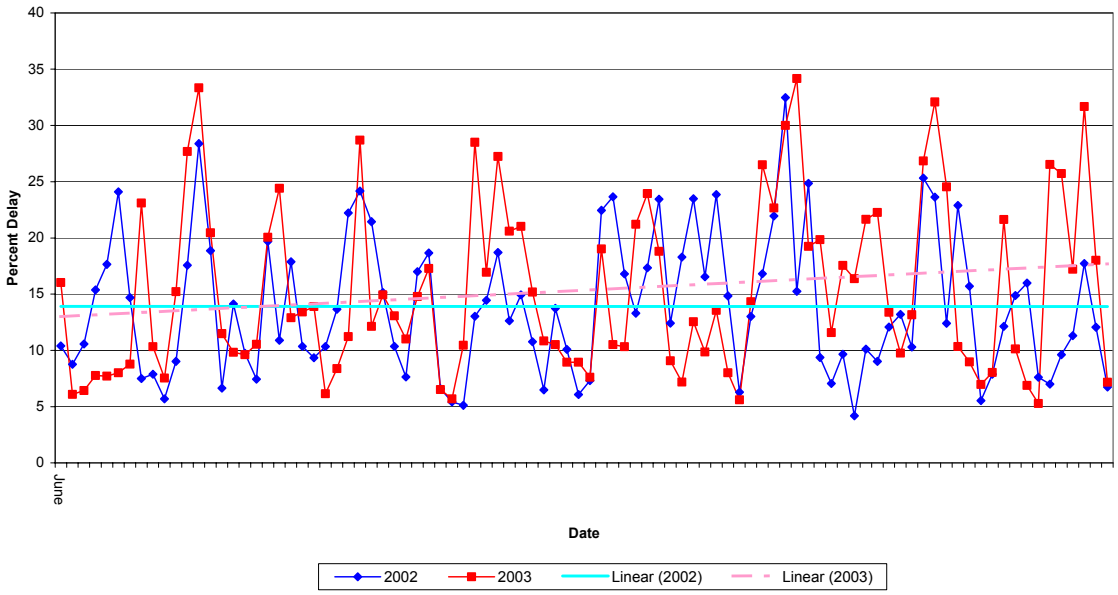
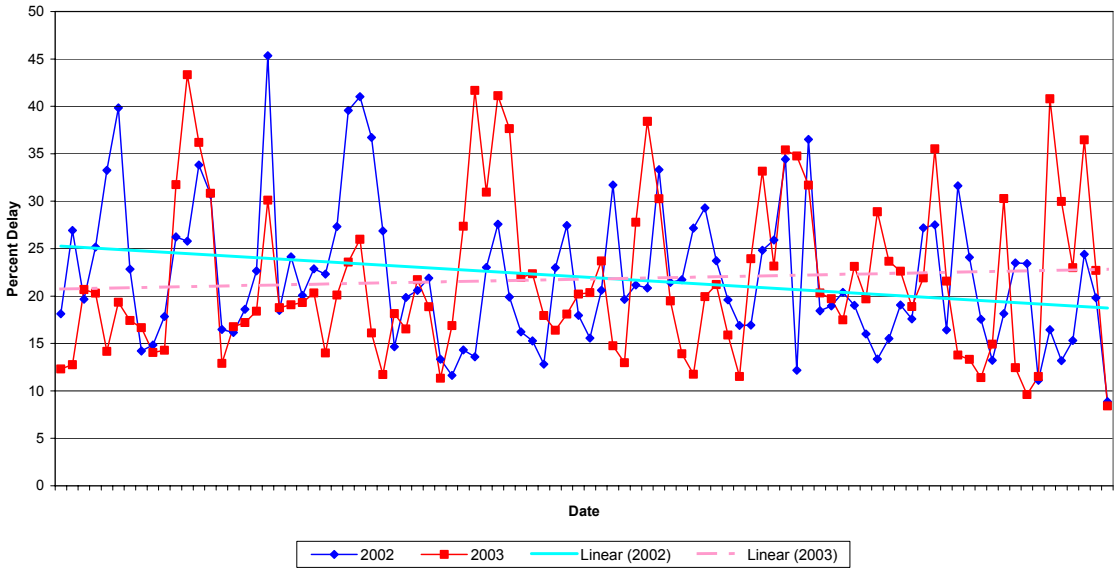


Figure D.25: Percent Departure Delay Reagan National - 2002 v. 2003



Summer Months (June, July, August)

Figure D.26: Percent Departure Delay Dulles - 2002 v. 2003
Summer Months (June, July, August)

Although the volume of departures and percent delay fluctuated between all three airports, minutes per delay remained consistent from 2002 to 2003. Figures D.27-D29 illustrate this consistency.

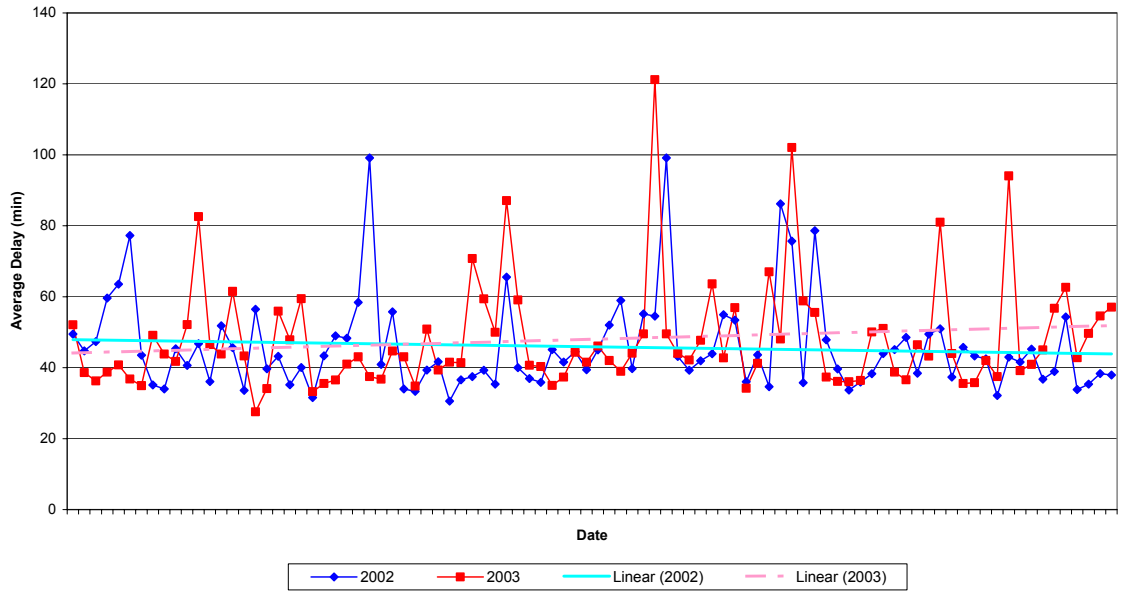


Figure D.27: Average Departure Delay Baltimore Washington International Airport - 2002 v. 2003
Summer Months (June, July, August)

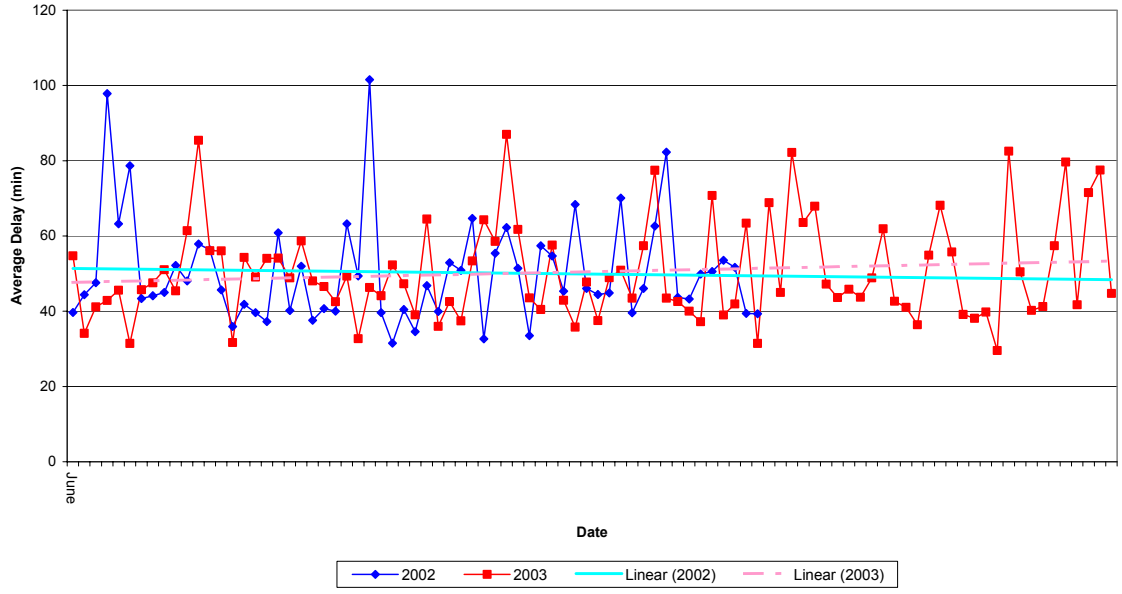


Figure D.28: Average Departure Delay Reagan National - 2002 v. 2003
Summer Months (June, July, August)

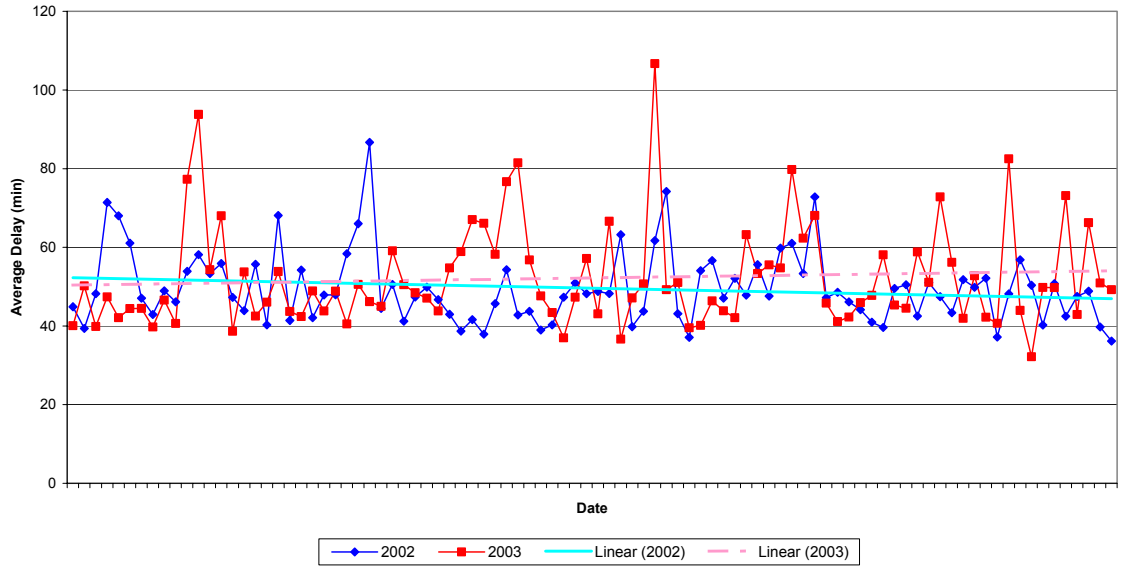


Figure D.29: Average Departure Delay Dulles - 2002 v. 2003
Summer Months (June, July, August)

Conclusions

Overall, TRACON consolidations have shown a positive trend with respect to number of delays

- In Atlanta, delays decreased slightly during the first year of consolidation while continuing to decrease significantly after two years
- Percent delays decreased significantly in Northern California, less than one year following consolidation
- Delays in the Potomac TRACON have decreased slightly and may continue to decrease, similar to Atlanta, as consolidation matures